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NORTHEAST ELECTRONICS
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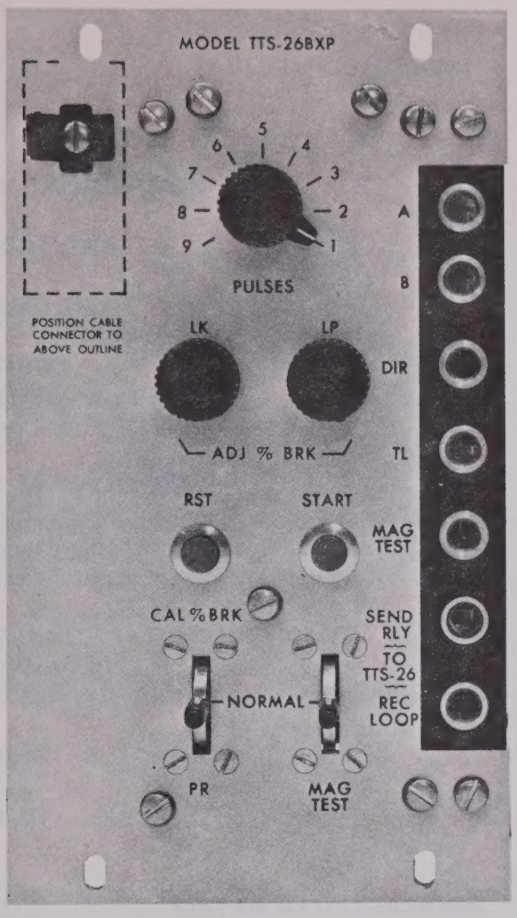
INSTRUCTION MANUAL

TTS 26BXP
PULSING PANEL

PRINTED IN U.S.A.
2.0C-0026-1077

No. A0026-55-600 ISSUE 2 DATE OCT 1977



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SECTION 1

GENERAL DESCRIPTION

1.1 The TTS 26BXP Pulsing Panel, in combination with a TTS 26BXC Circuit Panel and a TTS 26B Pulse Signaling Test Set, provides groups of pulses. . . or a continuous pulse train. . . through various loop, leak, and other test circuitry. Such preset groups of pulses are useful for testing step-by-step switches and pulse correcting repeaters.

1.2 The 26BXP Pulsing Panel makes it easy to generate test combinations of percent break, loop resistance, and leak. Combinations of these conditions can be set up to simulate the in-service conditions imposed on the pulsing mechanisms of switches and repeaters. A small, hand-held Remote Control Unit (26BXPC) allows push-button selection of the conditions which have been set on the 26BXP and its companion units (26BXC and 26B).

1.3 The 26BXP Pulsing Panel also contains provisions for direct pulsing of the switch magnets on step-by-step switches.

1.4 The 26BXP is designed for mounting in a detachable accessory cover (lid) available for the basic TTS 26B test set. (A 26BXC unit is normally also required in the accessory cover. Connections between the 26BXP and 26BXC are made via terminal strips within the cover.)

1.5 The accessory cover is the same size as the case of the basic 26B test set, i.e., 14 inches (35.6 cm) wide by 10 inches (25.4 cm) high by 6 inches (15.3 cm) deep. A fully equipped accessory cover adds about 10 pounds to the weight of the basic TTS 26B test set.

1.6 Power for the 26BXP Pulsing Panel is obtained via patching from the basic TTS 26B test set.

1.7 Jack designations on the 26BXP are consistent with the markings on various types of instruments that have been used in the industry.

1.8 Power and signal connections between the 26BXP unit and the basic 26B test are made via:

1. One cable with 5-pin lock-in connector;

2. Two patch cords having 310-type plugs on both ends.

1.9 In addition, the 26BXP has jacks for: (a) switch magnet testing, (b) loop pulse testing, and (c) direct access to contacts of the send relay in the 26B test set. Jacks are also included for connection of the remote Control Unit (Northeast 26BXPC or Western Electric 36B).

SECTION 2

SPECIFICATIONS

2.1 The TTS 26BXP Pulsing Panel, operating in conjunction with a TTS 26BXC Circuit Panel and TTS 26B Pulse Signaling Test Set, produces a specific number of pulses with selected percent break and other conditions. The pulsing panel's parameters are as follows.

Maximum Percent Break:	80% (at 12 pps)
Minimum Percent Break:	40% (at 12 pps)
Number of Pulses:	Selectable 1 to 9, or continuous
Power Requirements:	48 to 55 Vdc
Operating Temperature Range:	30°F to 130°F (−1°C to +54°C)
Size:	4-3/16 in w x 7-13/16 in h x 5 in d (10.6 cm x 19.8 cm x 12.7 cm)
Weight:	5 pounds (2.3 kg)

SECTION 3

INSTALLATION

3.1 The TTS 26BXP Pulsing Panel and other accessory panels are normally factory-installed in the accessory cover (lid) before shipment. In this case, the pulsing panel need only be "matched" to the basic TTS 26B test set with which it will be used. Refer to paragraph 6.4 for the 26B/26BXP percent break adjustment procedure necessary for "matching" the two units together.

3.2 If the 26BXP Pulsing Panel is purchased as an add-on to an existing accessory cover (lid) which already contains a 26BXC circuit panel, then the pulsing panel must be installed in the cover according to the instructions in the following paragraphs.

3.3 The installation procedure refers to the hinged side of the accessory cover as the **front** and the latch side as the **rear**. The 10-terminal strip in the front of the cover is reference designated TB1. The 21-terminal strip in the rear of the cover is reference designated TB2.

3.4 Generally the 26BXP Pulsing Panel is used with a 26BXC Circuit Panel in the same accessory cover. Therefore, the following installation procedure assumes that the accessory cover in which the 26BXP panel is to be installed already has a 26BXC unit mounted in the left hand side. A blank filler panel is assumed to be mounted in the center of the accessory cover. (If a 26BXPS Power Supply is mounted in the center, this power supply must be exchanged for a right-hand mounting version so the center of the accessory cover will be available to accept the 26BXP Pulsing Panel.)

NOTE

The right hand side of the accessory cover may contain either: (a) blank filler panel, (b) TTS 26BXS SF Signal Circuit Test Panel, or (c) TTS 26BXPS Power Supply.

3.5 The installation procedure also assumes that the accessory interconnecting cable has previously been installed. Figure 3—2 shows the accessory cover interconnections.

3.6 To install a TTS 26BXP Pulsing Panel, perform the following steps.

1. Free the accessory cable plug from the mounting clip.

2. Loosen and remove the screws securing the panels to the cover. . . four screws to each panel. Save the screws and washers.

3. Lift out the center panel.

4. Carefully lift out the right-hand panel.

NOTE

If the right-hand panel is an accessory panel, wires from the panel are connected to a terminal block inside the cover.

5. Very carefully lift out the left-hand panel.

NOTE

The accessory cable remains attached to the terminal block inside the cover.

6. Remove the shorting bars on terminal block TB2 at positions 5-6, 10-11, and 12-13. See Figure 3—1.

7. Remove the red and black wires between terminal block TB1 and terminal block TB2.

8. Connect the five-wire cable of TTS 26BXP Pulsing Panel to terminal block TB1. See Figure 3—1 for harness orientation and wire positions.

9. Connect the 20-wire cable of TTS 26BXP Pulsing Panel to terminal block TB2. See Figure 3—1 for harness orientation and wire positions.

10. Bend the cable from TTS 26BXC circuit panel around the end of the terminal block. Push remaining cable under case rail before mounting the circuit panel.

NOTE

When mounting the accessory panels, do not pinch or scrape any wires or components. Make sure that the cables do not hinder operation of the A relay on the circuit panel or the RM stepping switch on the pulsing panel.

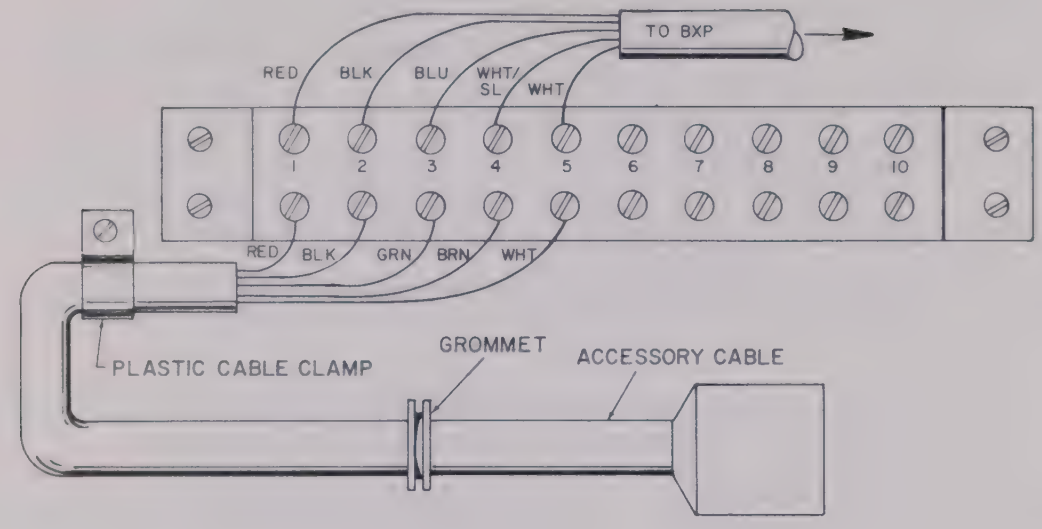
11. Mount the TTS 26BXC Circuit Panel on the left in the accessory cover.

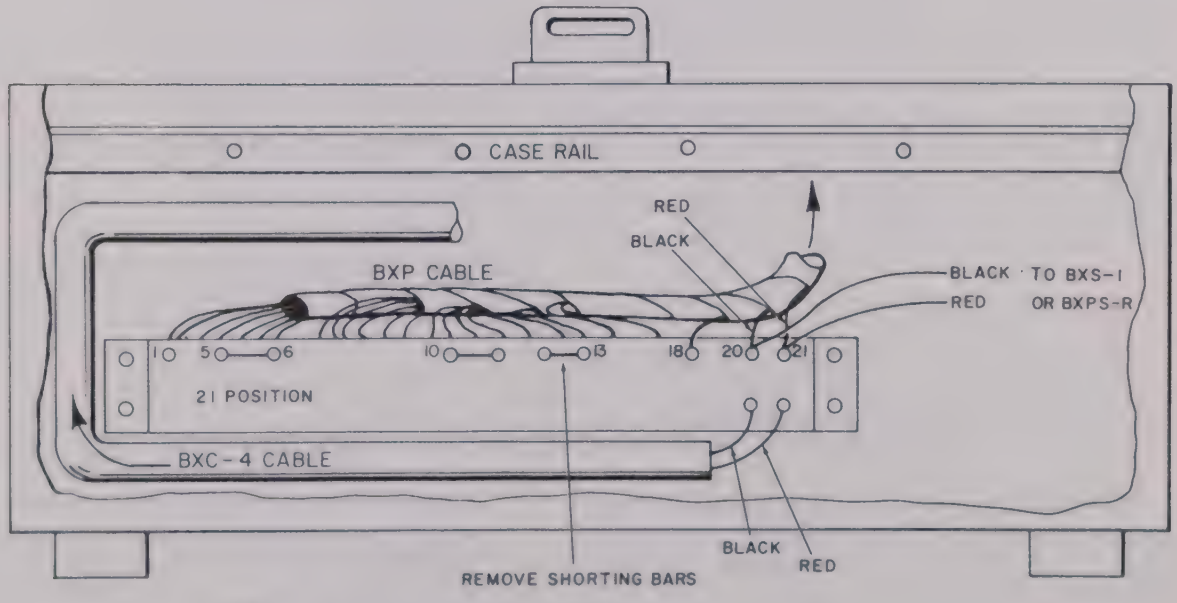
12. Mount the TTS 26BXP Pulsing Panel in the center of the accessory cover.

13. Mount the right hand filler panel or other accessory unit.

14. Secure all three panels with screws removed in step 2.

15. Perform the TTS 26B/TTS 26BXP percent break adjustment as outlined in paragraph 6.4.

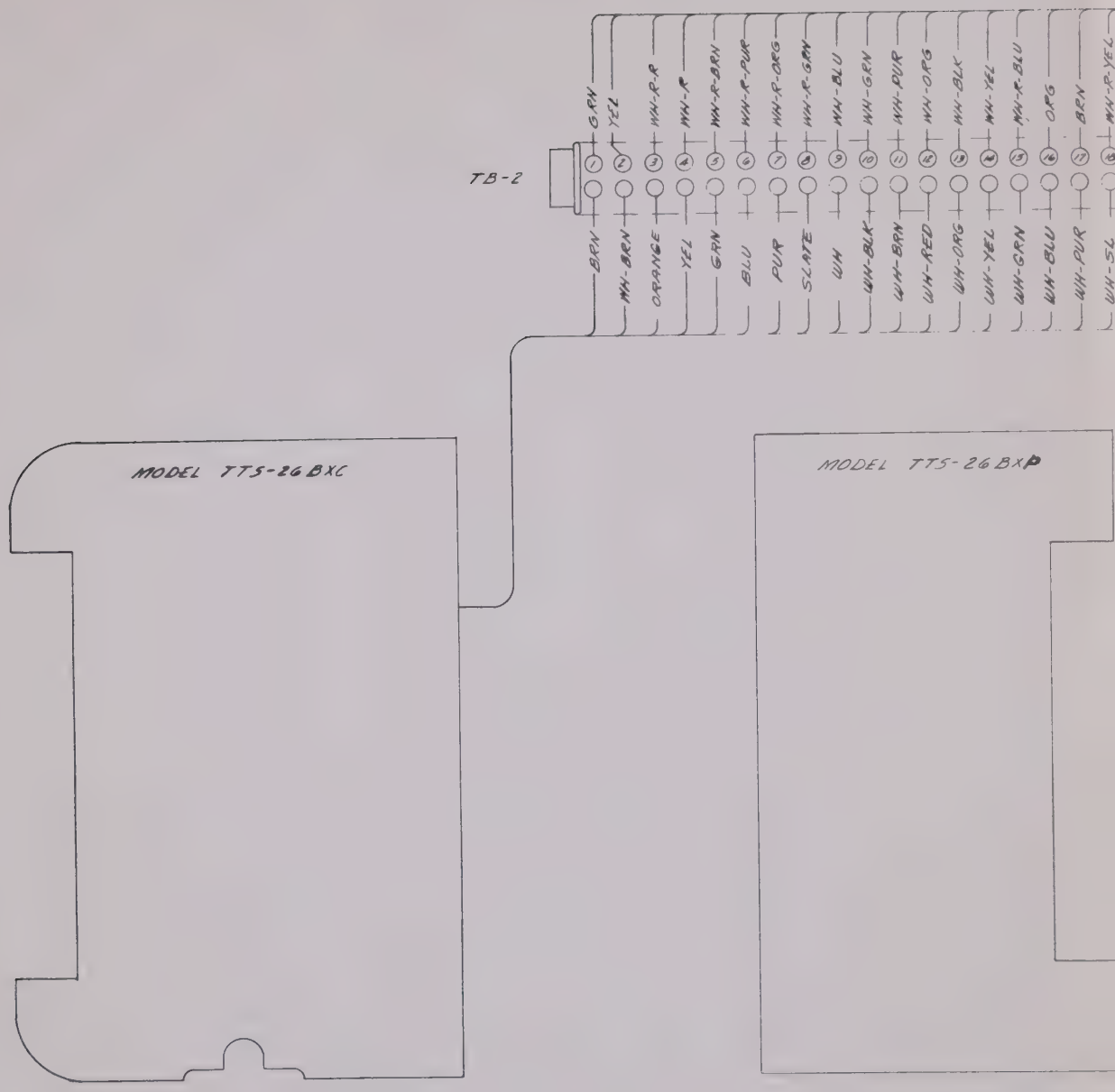


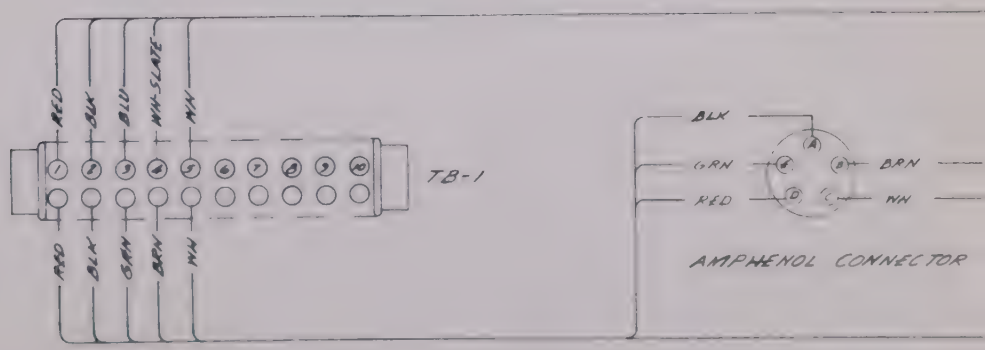


NOTES:

1. BEND BXC-4 CABLE AROUND END OF TERMINAL BLOCK. PUSH REMAINING CABLE UNDER CASE RAIL BEFORE MOUNTING BXC-4.
2. POSITION 19 NOT USED.

Figure 3—1. Cable Orientations And Positioning


TB-2
GRN
YEL
WH-BRN
ORANGE
WH-X-P
WH-X-BRN
BLU
WH-X-PUR
WH-X-ORG
SLATE
WH-X-GRY
WH-BLU
WH-GRN
WH-BLK
WH-BRN
WH-PUR
WH-RED
WH-ORG
WH-BLK
WH-YEL
WH-GRN
WH-X-BLU
WH-BLU
ORG
BRN
WH-PUR
WH-SL
MODEL TTS-26BXC
MODEL TTS-26BXP


RED
BLK
BLU
WH-SLATE
WH
TB-1
BLK
GRN
RED
BRN
WH
AMPHENOL CONNECTOR

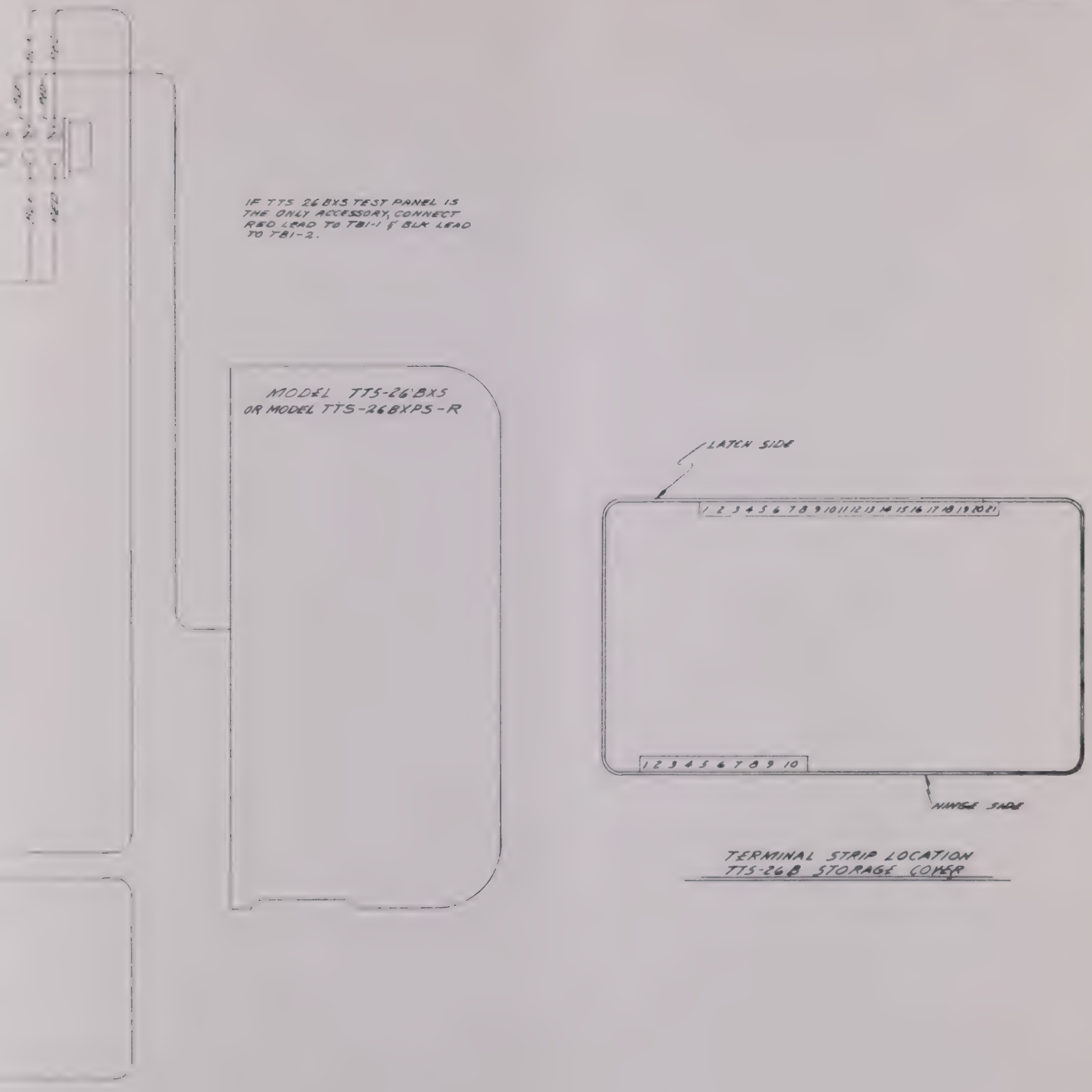

IF TTS 26BXS TEST PANEL IS THE ONLY ACCESSORY, CONNECT RED LEAD TO TB1-1 & BLK LEAD TO TB1-2.
MODEL TTS-26BXS OR MODEL TTS-26BXPS-R
LATCH SIDE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
1 2 3 4 5 6 7 8 9 10
HINGE SIDE
TERMINAL STRIP LOCATION
TTS-26B STORAGE COVER

Figure 3—2. Accessory Cover Interconnections

SECTION 4

OPERATION

4.1 CONTROLS AND JACKS

4.2 Figure 4—1 shows the controls and jacks of the TTS 26BXP Pulsing Panel. Table 4—1 describes the functions of these controls and jacks.

Table 4—1. Pulsing Panel Controls And Jacks.

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
J1, J2	A, B jacks	The A and B jacks are used by the TTS 26BXP Remote Control Unit or the equivalent Western Electric 36B test set to initiate tests and to control the percent break associated with leak or loop testing. The knurled side of the plug on the 26BXPC connecting cord goes toward the A jack. If a Western Electric 36B test set is used, the knurled side of the plug should be toward the A jack (the cord should project toward the left).
J3	DIR jack	This jack gives access to the pulsing output before it passes through the TTS 26BXC Circuit Panel.
J4	TL jack	This jack is used to test circuits requiring a "busy" test followed by a "ground forward" on the sleeve to the circuit under test. The tip and ring leads of the TL jack are internally connected to the tip and ring leads of R, LP, SX, RLY jack on the TTS 26BXC Circuit Panel.
J5	MAG TEST jack	This jack is used for pulsing directly into the magnets of step-by-step switches.
J6, J7	SEND RLY TO TTS-26 jack, TO TTS-26 REC LOOP jack	These jacks are used to interconnect the basic TTS 26B test set with the TTS 26BXP Pulsing Panel.
R15, R16	ADJ % BRK LP and LK potentiometers	These controls set the percent break for calibration, magnet, leak, and loop tests.
S1	NORMAL/MAG TEST key switch	When this key switch is set a MAG TEST and the CAL % BRK/NORMAL/PR switch is set at NORMAL, a group of pulses is sent into the magnet of a step-by-step switch connected to the MAG TEST jack.
S2	CAL % BRK/NORMAL/PR key switch	In CAL % BRK position this switch returns pulsing back to the TTS 26B test set. The percent break can then be adjusted (with the test set correctly set up) by: 1. ADJ % BREAK control on TTS 26B, 2. LP ADJ % BRK control on TTS 26BXP after pressing LP pushbutton on TTS 26BXPC or,

Table 4—1 (Cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
		3. LK ADJ % BRK control on TTS 26BXP after pressing LK pushbutton on TTS 26BXPC. In PR position, this switch overrides the PULSES switch on the pulsing panel and allows continuous pulsing to pass through the pulsing panel. The pulsing is gated through the pulsing panel by: 1. Momentarily pressing the START pushbutton on the pulsing panel, or 2. Momentarily pressing either the LP or LK pushbutton on the TTS 26BXPC control unit. The pulsing can then be stopped by: 1. Pressing the RST pushbutton on the pulsing panel, or 2. Pressing the RLS pushbutton on the control unit.
S3	START pushbutton	This pushbutton, when momentarily pressed, initiates the sending of a group of pulses as set up on the pulsing panel. The pulses are routed to jacks on the TTS 26BXP and TTS 26BXC panels.
S4	RST pushbutton	This pushbutton, when momentarily pressed, releases the internal functions within the pulsing panel and restores to normal the step-by-step switch under test.
S5	PULSES rotary switch	This switch controls the number of pulses (1-9) in a group that the pulsing panel will pass.

4.3 USING THE TTS 26BXP PULSING PANEL

4.4 A typical test set up for use of the TTS 26BXP is shown in Figure 4—2. A procedure for using the instrument to pulse step-by-step switches with desired loop and leak conditions is outlined as an operational flow chart in Figure 4—3. The operational flow chart also provides instructions for pulsing switch magnet and other circuits.

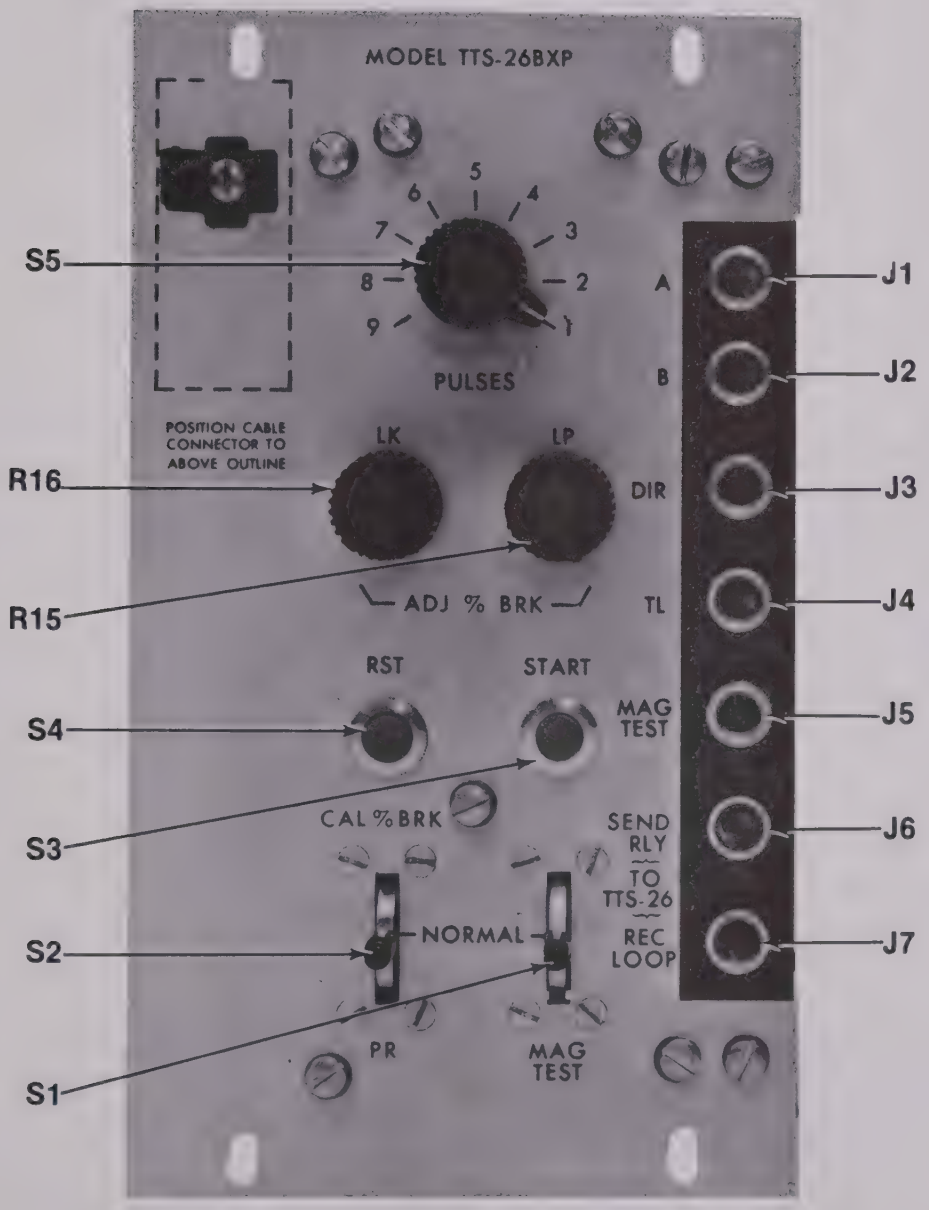


Figure 4—1. Controls And Jacks.

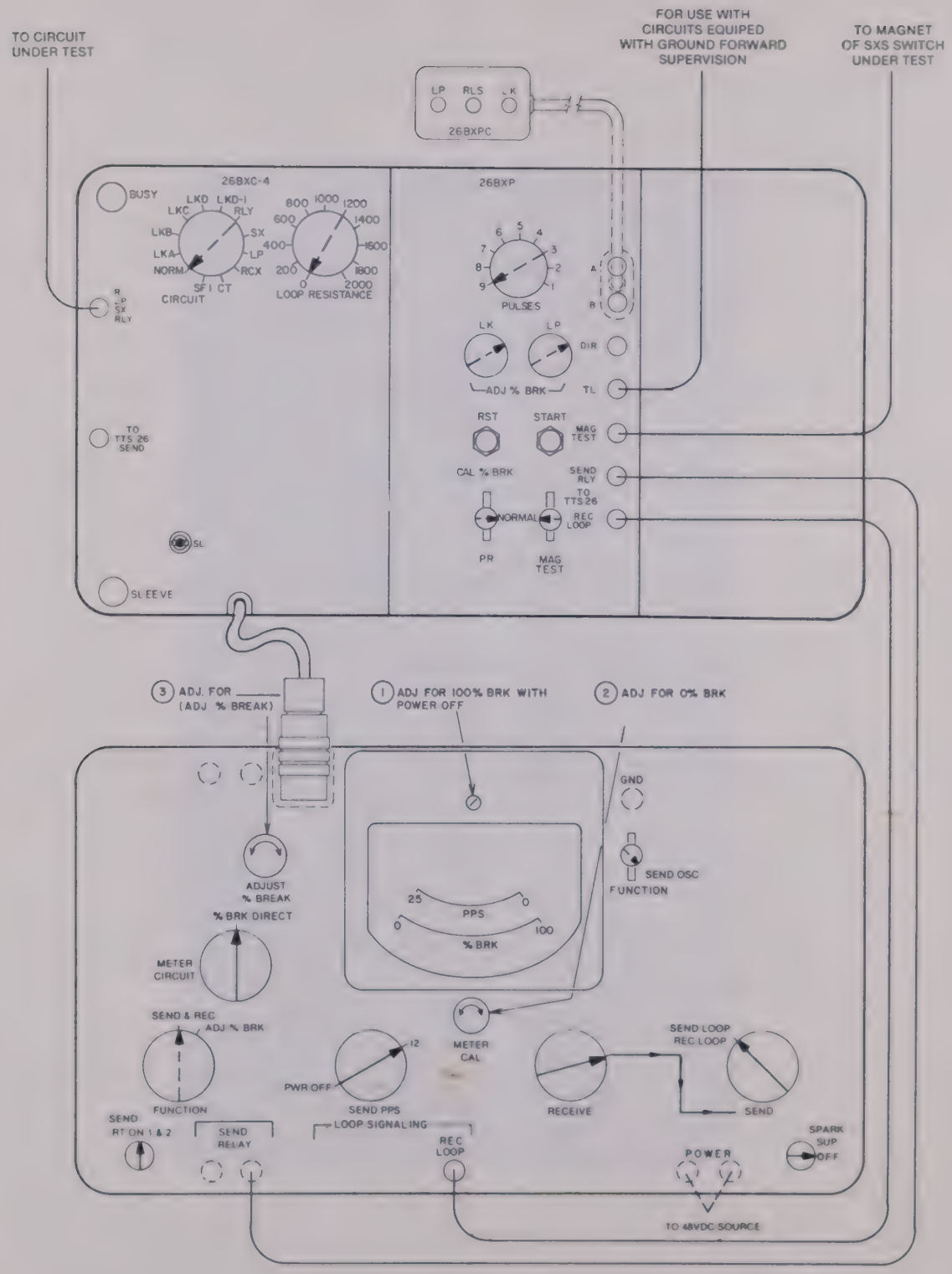


Figure 4—2. Typical Test Set-Up.

1. WITH NO POWER APPLIED TO TTS 26B TEST SET, CHECK THAT THE METER READS 100.0 PERCENT. ADJUST THE METER SCREW AS NECESSARY

2. AFTER AN ADJUSTMENT, BACK OFF THE ADJUSTMENT SLIGHTLY TO REMOVE MECHANICAL CONTACT BETWEEN THE SCREW AND THE METER MECHANISM

1. INSERT THE TTS 26BXPC CONTROL PLUG INTO THE A AND B JACKS ON THE TTS 26BXP PULSING PANEL. THE KNURLED SIDE MUST FACE TOWARD THE A JACK.

2. INSERT THE CONNECTOR PLUG ON THE CORD FROM THE ACCESSORY COVER INTO THE EXTERNAL ADAPTER JACK ON THE TTS 26B TEST SET AND LOCK IT IN.

3. PATCH THE SEND RELAY JACK (ON TTS 26B) WITH THE SEND RLY JACK (ON TTS 26BXP) USING A THREE—CONDUCTOR CORD WITH 310—TYPE PLUG.

4. PATCH THE REC LOOP JACK (ON TTS 26B) WITH REC LOOP JACK (ON TTS 26BXP) USING A (TIP—RING) CORD WITH 310—TYPE PLUGS

NOTE

IF ACCESSORY COVER HAS A TTS 26BXPS POWER SUPPLY, OMIT STEPS 1 AND 2. PLUG POWER SUPPLY CORD INTO A 115 VAC POWER SOURCE.

1. INSERT THE 310—TYPE PLUG OF A TIP—SLEEVE PATCH CORD INTO ONE OF THE 26B TEST SET'S 48 VOLTS JACKS. OBSERVE THAT CORRECT POLARITY IS MAINTAINED FOR THE POWER SOURCE TO BE USED

2. CONNECT THE OTHER END OF THE PATCH CORD TO THE 48 VDC POWER SOURCE.

NOTE

IF USING A POWER SOURCE OTHER THAN CO BATTERY, CONNECT A JUMPER BETWEEN THE TEST SET GND BINDING POST AND CO GROUND.

3. SET 26B SEND PPS SWITCH AT 12.

4. SET 26B FUNCTION SWITCH AT CAL MTR AND ADJUST METER CAL CONTROL TO OBTAIN 0.0 PERCENT ON THE METER.

NOTE

THE TEST SET SHOULD BE USED IN THE POSITION THAT IT WAS CALIBRATED, EITHER VERTICALLY OR HORIZONTALLY.

1. SET 26B FUNCTION KEY SWITCH AT SEND OSC

2. SET 26B SEND TURN BUTTON AT RT ON 1 AND 2

3. SET 26B SPARK SUP TURN BUTTON AT OFF.

4. SET 26B METER CIRCUIT SWITCH AT % BREAK DIRECT.

5. SET 26B RECEIVE SWITCH FULLY CLOCKWISE

6. SET 26B SEND SWITCH AT SEND LOOP REC LOOP.

7. SET 26B FUNCTION SWITCH AT SEND & REC.

ON THE TTS 26BXC CIRCUIT PANEL

1. SET CIRCUIT SWITCH AT NORM

2. SET LOOP RESISTANCE SWITCH AT 0

3. SET ADD SWITCH AT 0.

4. VERIFY THAT SL SWITCH IS RELEASED (CENTER POSITION)

NOTES:

1. SOME TESTS ON INCOMING SELECTORS REQUIRE 45% INSTEAD OF 60.5% UNDER LEAK CONDITIONS AND 78% INSTEAD 68.5% UNDER LOOP CONDITIONS. FOR THESE TESTS, ADJUST FOR 45% AND 78% IN STEPS 3 AND 5 RESPECTIVELY.

2. TO TEST PULSE REPEATERS AND PULSE CORRECTION CIRCUITS, ADJUST FOR 40% AND 75% IN STEPS 3 AND 5 RESPECTIVELY.

3. AT THE START OF A MAGNET TEST (PRESSING LK PUSHBUTTON ON THE TTS 26BXPC CONTROL UNIT) A HOLDING LOOP IS PLACED ACROSS THE A RELAY IF THE CIRCUIT UNDER TEST IS IDLE. THIS ACTION REMOVES THE A RELAY FROM THE PULSING PATH TO PERMIT MAKING THE TEST AND BUSIES OUT THE SWITCH UNDER TEST. A SERIES OF 1 TO 9 GROUND PULSES ARE THEN TRNASMITTED TO THE SWITCH MAGNET WITHOUT DISTORTIONS INTRODUCED BY AN A RELAY. THE PERCENT BREAK IS 67% UNDER LKA CONDITIONS AND 60.5% UNDER LKB CONDITIONS.

4. A GROUND APPEARS ON THE SLEEVE OF THE TL JACCK AT THE START OF A TEST (PRESSING EITHER LP OR LK PUSHBUTTONS ON THE TTS 26BXPC CONTROL UNIT). THE GROUND REMAINS PRESENT UNTIL SUCH TIME AS THE RLS PUSHBUTTON (OR RST PUSHBUTTON ON THE PULSING PANEL) IS PRESSED.

5. THE DIR JACK ON THE TTS 26BXP PULSING PANEL GIVES DIRECT ACCESS TO PULSES FROM THE PULSING PANEL WITHOUT PASSING THROUGH THE LOOP AND LEAK CIRCUITS.

6. BEFORE USING THE SEND JACKS ON THE TTS 26B TEST SET, DISCONNECT THE PATCH BETWEEN THE SEND RELAY JACK (ON TTS 26B) AND THE SEND RLY JACK (ON TTS 26BXP) AND PRESS RST PUSHBUTTON ON THE PULSING PANEL.

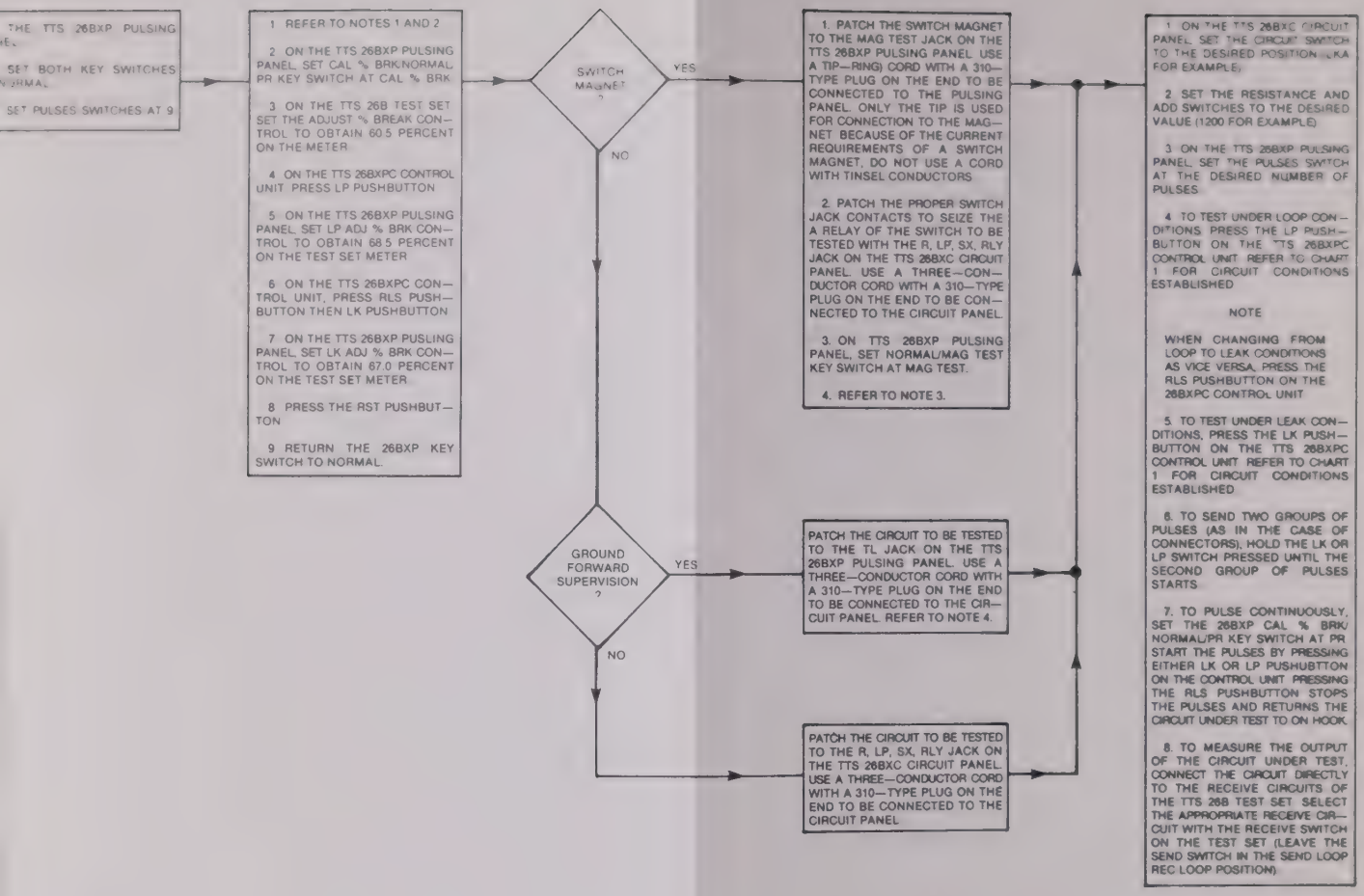

THE TTS 26BXP PULSING
SET BOTH KEY SWITCHES
SET PULSES SWITCHES AT 9
1 REFER TO NOTES 1 AND 2
2 ON THE TTS 26BXP PULSING PANEL SET CAL % BRK/NORMAL PR KEY SWITCH AT CAL % BRK
3 ON THE TTS 26B TEST SET SET THE ADJUST % BREAK CONTROL TO OBTAIN 60.5 PERCENT ON THE METER
4 ON THE TTS 26BXPC CONTROL UNIT PRESS LP PUSHBUTTON
5 ON THE TTS 26BXP PULSING PANEL SET LP ADJ % BRK CONTROL TO OBTAIN 68.5 PERCENT ON THE TEST SET METER
6 ON THE TTS 26BXPC CONTROL UNIT, PRESS RLS PUSHBUTTON THEN LK PUSHBUTTON
7 ON THE TTS 26BXP PUSLING PANEL SET LK ADJ % BRK CONTROL TO OBTAIN 67.0 PERCENT ON THE TEST SET METER
8 PRESS THE RST PUSHBUTTON
9 RETURN THE 26BXP KEY SWITCH TO NORMAL.
SWITCH MAGNET ?
YES
NO
1. PATCH THE SWITCH MAGNET TO THE MAG TEST JACK ON THE TTS 26BXP PULSING PANEL USE A TIP—RING) CORD WITH A 310—TYPE PLUG ON THE END TO BE CONNECTED TO THE PULSING PANEL. ONLY THE TIP IS USED FOR CONNECTION TO THE MAGNET BECAUSE OF THE CURRENT REQUIREMENTS OF A SWITCH MAGNET, DO NOT USE A CORD WITH TINSEL CONDUCTORS
2. PATCH THE PROPER SWITCH JACK CONTACTS TO SEIZE THE A RELAY OF THE SWITCH TO BE TESTED WITH THE R, LP, SX, RLY JACK ON THE TTS 26BXC CIRCUIT PANEL. USE A THREE—CONDUCTOR CORD WITH A 310—TYPE PLUG ON THE END TO BE CONNECTED TO THE CIRCUIT PANEL.
3. ON TTS 26BXP PULSING PANEL, SET NORMAL/MAG TEST KEY SWITCH AT MAG TEST.
4. REFER TO NOTE 3.
GROUND FORWARD SUPERVISION ?
YES
NO
PATCH THE CIRCUIT TO BE TESTED TO THE TL JACK ON THE TTS 26BXP PULSING PANEL. USE A THREE—CONDUCTOR CORD WITH A 310—TYPE PLUG ON THE END TO BE CONNECTED TO THE CIRCUIT PANEL. REFER TO NOTE 4.
PATCH THE CIRCUIT TO BE TESTED TO THE R, LP, SX, RLY JACK ON THE TTS 26BXC CIRCUIT PANEL. USE A THREE—CONDUCTOR CORD WITH A 310—TYPE PLUG ON THE END TO BE CONNECTED TO THE CIRCUIT PANEL
1 ON THE TTS 26BXC CIRCUIT PANEL SET THE CIRCUIT SWITCH TO THE DESIRED POSITION (LKA FOR EXAMPLE)
2 SET THE RESISTANCE AND ADD SWITCHES TO THE DESIRED VALUE (1200 FOR EXAMPLE)
3 ON THE TTS 26BXP PULSING PANEL SET THE PULSES SWITCH AT THE DESIRED NUMBER OF PULSES
4 TO TEST UNDER LOOP CONDITIONS PRESS THE LP PUSHBUTTON ON THE TTS 26BXPC CONTROL UNIT REFER TO CHART 1 FOR CIRCUIT CONDITIONS ESTABLISHED
NOTE
WHEN CHANGING FROM LOOP TO LEAK CONDITIONS AS VICE VERSA, PRESS THE RLS PUSHBUTTON ON THE 26BXPC CONTROL UNIT
5 TO TEST UNDER LEAK CONDITIONS, PRESS THE LK PUSHBUTTON ON THE TTS 26BXPC CONTROL UNIT REFER TO CHART 1 FOR CIRCUIT CONDITIONS ESTABLISHED
6 TO SEND TWO GROUPS OF PULSES (AS IN THE CASE OF CONNECTORS), HOLD THE LK OR LP SWITCH PRESSED UNTIL THE SECOND GROUP OF PULSES STARTS
7. TO PULSE CONTINUOUSLY, SET THE 26BXP CAL % BRK/NORMAL/PR KEY SWITCH AT PR START THE PULSES BY PRESSING EITHER LK OR LP PUSHUBTTON ON THE CONTROL UNIT PRESSING THE RLS PUSHBUTTON STOPS THE PULSES AND RETURNS THE CIRCUIT UNDER TEST TO ON HOOK.
8. TO MEASURE THE OUTPUT OF THE CIRCUIT UNDER TEST, CONNECT THE CIRCUIT DIRECTLY TO THE RECEIVE CIRCUITS OF THE TTS 26B TEST SET. SELECT THE APPROPRIATE RECEIVE CIRCUIT WITH THE RECEIVE SWITCH ON THE TEST SET (LEAVE THE SEND SWITCH IN THE SEND LOOP REC LOOP POSITION)

CHART 1 LOOP CIRCUIT CONDITIONS

CIRCUIT SWITCH ON TTS 26BXC	PUSHBUTTON ON TTS 26BXPC		SEND CIRCUIT CONDITION		
	LK	LP	% BREAK	LEAK	LOOP
NORMAL	X		67.0	IN	OUT
NORMAL		X	68.5	OUT	IN
LKA	X		60.5	IN	OUT
LKA		X	68.5	OUT	IN
LKB	X		60.5	IN	OUT
LKB		X	68.5	OUT	IN
LKC	X		60.5	IN	OUT
LKC		X	68.5	OUT	IN

Figure 4—3. Operational Flow Chart.

SECTION 5

THEORY OF OPERATION

5.1 The 26BXP Pulsing Panel is normally used in conjunction with a 26BXC Circuit Panel and a 26B Pulse Signaling Test Set. The basic TTS 26B test set generates the pulses. The 26BXP Pulsing Panel:

1. Controls the number of pulses actually gated into a circuit or device under test,

2. Performs switching functions which initiate/terminate pulse sending and also control the percent break, loop resistance, and leak conditions imposed on the pulsing.

The 26BXC Circuit Panel contains the loop resistance and leak networks which are imposed on the pulsing under control of the 26BXP Pulsing Panel.

5.2 A 26BXPC Remote Control unit, with a 12-foot cord, plugs into the 26BXP Pulsing Panel to enable control over the unit's pulsing capabilities from a short distance away.

5.3 Figure 7—1 is an overall schematic diagram showing the complete 26BXP and 26BXPC units plus some circuits of the 26B test set and 26BXC Circuit Panel. Figures 5—1 through 5—9 are simplified schematics showing only those electronic functions associated with given test operations.

5.4 Prior to operation of the Pulsing Panel, certain tests on inter-unit patching connections must be made as shown in Figure 4—2. Also, certain calibrations must be performed as described in Figure 4—3. When these tasks have been performed, the equipment will be supplying continuous pulsing at the speed and percent break which have been selected by a user.

5.5 In the idle condition, pulses generated by the DRIVE relay in the 26B test set are applied to the armature of STF (start follow) relay K2 in the 26BXP Pulsing Panel. However, since the STF relay is released, these pulses are not permitted to reach any of the 26BXP's gating functions.

5.6 Also in idle condition, CMP (clamp) relay K6 in the Pulsing Panel is operated, thus extending ground (via the CLAMP LEAD signal line) to the SEND relay in the 26B test set. This ground maintains the 26B's SEND relay in a steady off hook (closed loop) state.

5.7 For normal loop pulsing, the test set's SEND relay contacts are switch-connected through the 26BXP Pulsing Panel to the loop and leak networks of the 26BXC Circuit Panel. Thus, pulses generated by the 26B's SEND relay are actually applied to a circuit under test through both the Pulsing Panel and the Circuit Panel.

5.8 When pulsing panel key switch S1 is in MAG TEST position, the make contact of the test set SEND relay is switched to the tip of pulsing panel MAG TEST jack J5. The armature of the SEND relay connects to ground via a make contact of pulsing panel CMPF (clamp follow) relay K11. Thus, ground and open pulsing are generated for magnet testing.

5.9 During calibration, pulsing panel keyswitch S2 is positioned at CAL % BREAK. In this position, the ground applied to the test set SEND relay (via the clamp lead) is interrupted by a contact of switch S2. And, the test set's SEND relay contacts are routed back to the receive portion of the test set. In this condition, the SEND relay operates under direct control of the test set's DRIVE relay. The pulsing now routed to the receive portion of the TTS 26B test set can be measured by the test set.

5.10 The PR position of pulsing panel key switch S2 interrupts the ground applied to the test set SEND relay via the clamp lead. This PR switch position allows transmission of a continuous pulse train to the circuit under test.

5.11 In NORMAL position of pulsing panel switch S2, pulses are applied to the circuit under test via gating function in the pulsing panel. The number of pulses within a pulse train depends on the position of PULSES switch S5 on the pulsing panel. The pulses within a given train can range from 1 to 9, as selected by the PULSES switch.

5.12 LOOP TESTING FUNCTIONS

5.13 Refer to Figure 5—1. The gating functions of the TTS 26BXP are placed in operation by pressing either the LP or LK pushbutton on the remote control unit. Either of these pushbuttons, when pressed, extends a ground to ST (start) relay K4 in the pulsing panel. The ground originates at the BS (busy) relay in the 26BXC Circuit Panel.

NOTE

Should a circuit under test be busy, The BS relay is operated and no ground is established. This makes it impossible for the 26BXP Pulsing Panel to start a test.

5.14 Assuming the circuit under test is idle, the established ground operates ST (start) relay K4 in the pulsing panel. Operated ST relay extends battery (through current limiting resistor R2) to STF (start follow) relay K2. STF relay operates only when the 26B test set's DRIVE relay is deenergized. This ensures that the pulsing panel's gating functions start in correct phase with the test set DRIVE relay. It makes certain that the first pulse applied to the pulsing panel RM stepping switch (or to the circuit under test in PR mode) is of the same duration as those pulses that follow. Sustaining voltage is supplied to the STF relay via resistors R3 and R4.

5.15 Operated STF relay extends the DRIVE relay pulsing circuit to RM stepping switch K3. Ground pulses generated by the DRIVE relay cause RM switch K3 to step.

5.16 Prior to RM switch K3 moving from its home position (Figure 5—1 shows RM in home position), CMP (clamp) relay K6 is held energized. In the case of normal loop pulsing the CMP relay is not released until after the RM switch has taken its third step. Simultaneously with the first RM switch step, OH (off hook) relay K10 is operated to complete the loop circuit. The completed loop circuit extends an off hook condition to the circuit under test.

5.17 The RM stepping switch, when leaving the third position, removes ground from the coil of CMP relay to deenergize the CMP relay. Released CMP relay removes the ground from the clamp lead, hence from the test set's SEND relay. The SEND relay can now follow pulses generated by the DRIVE relay to apply dc interruptions on the loop under test.

5.18 These dc interruptions continue until such time as RM stepping switch steps from position 11 to home position. Upon returning to home position, ground on the wiper of RM switch is extended to CMP relay. The CMP relay, in turn, applies ground to the clamp lead thus, stopping the test set's SEND relay in an off hook condition. In the described operation, a total of 9 pulses have been transmitted to the circuit under test. This assumes, of course, that PULSES switch S5 is in position 9.

5.19 With the PULSES switch set at position 7 for example, the dc interruptions would continue until the RM switch steps to position 10. At that time ground would be extended to the CMP relay via the wiper of PULSE switch S5. In this example, seven dc interruptions would have occurred while RM switch stepped from position 3 to position 10.

5.20 When returning to its home position, the RM stepping switch also applies ground through diode CR8 at the junction of resistor R3 and R4. This ground removes the sustaining voltage for STF relay K2, thus allowing the STF relay to release. When the STF relay is released, no further pulsing of the RM switch is possible until a new start command has been received.

5.21 Note that OH relay remains energized over its own latching contact to the ground established by the BS relay. This holds the circuit under test in an off hook condition. Momentarily pressing the RLS pushbutton returns the circuit under test to on hook. The RLS pushbutton, when pressed, applies a ground at the junction of diode CR14 and resistor R17 to release OH (off hook) relay K10. This, in turn, interrupts the loop circuit and places it on hook.

5.22 In conjunction with the previous operation, other relays such as LK1, LK2, LK3, and LP perform such functions as establishing the proper percent break and the switching in and out of the various leak and loop conditions as required. The operation of these relays will be explained in more detail later.

5.23 START switch S3 and RST switch S4, which are located on the pulsing panel, allow starting and resetting the pulsing panel in the absence of the TTS 26BXPC control unit. Keep in mind that when starting the pulsing panel with START switch, the percent break of the transmitted pulses will be directly controlled by ADJUST % BREAK control on the TTS 26B test set and that the leak and loop values will be as selected by the associated switches on the TTS 26BXC Circuit Panel.

5.24 DIR jack J3 on the pulsing panel provides direct access to the contacts of the 26B test set's pulsing relay. This jack is equipped with disconnect springs to remove any leak or loop conditions established by the TTS 26BXC circuit panel, if applicable. When jacking into DIR jack J3, a ground is established in lieu of that normally supplied by the BS relay within the TTS 26BXC circuit panel.

5.25 MAGNET TESTING FUNCTIONS

5.26 Magnet testing is performed by moving pulsing panel key switch S1 to the MAG TEST position. The magnet of the switch under test must be jacked into MAG TEST jack J5. The loop circuit of the switch under test connects to the R, LP, XS, RLY jack of the TTS 26BXC circuit panel. This places the loop circuit of the switch under test in an off hook condition (assuming that circuit to be free prior to pressing the LK button). If that circuit is not free, the BS relay will operate, rendering any further testing impossible.

5.27 With reference to Figure 5—2, it can be seen that pulsing panel CMPF (clamps follow) relay K211 is now brought into operation. The CMPF relay extends ground to the test set SEND relay during the period when the

SEND relay contacts are opened and prior to the transmission of the first ground pulse to the magnet under test. Note that under normal loop operation a closed loop (or off hook) condition is established by pulsing panel OH relay K10 when the SEND relay contacts are closed.

5.28 Other functions associated with operations of CMP and CMPF relays are also switched when pulsing panel key switch S1 is moved to MAG TEST position. These functions provide proper timing between the operation of the CMP relay and drive pulses as delivered by the test set DRIVE relay. This timing differs from that of normal loop operation, in that the test set SEND relay must be placed in operation approximately 180° earlier in time than for normal loop operation. If this timing was not shifted, and the pulsing panel CMPF and OH relays were to operate during the off hook duration of the send pulse, only a portion of a ground pulse would be applied to the magnet under test. The new timing ensures that the test set SEND relay is in an on hook condition during the period when pulsing panel OH and CMPF relays perform their switching which extends ground to the test set SEND relay. Thus, under this condition, the first pulse applied to a magnet under test will be of proper duration.

5.29 Also, the ground extended to the test set SEND relay must be removed upon the completion of the last ground pulse transmitted to a magnet under test. Depending on the position of PULSES switch S5, ground will be extended via the arm of RM stepping switch K3 and the RM contact to CMPF relay, thus causing the CMPF relay to release after the last transmitted pulse. Capacitor C2 (switched into the coil circuit of CMP relay when in MAG TEST operation) delays the release of CMP relay to ensure that the release of CMP relay be in the correct phase relationship with respect to operation of the test set DRIVE relay. Capacitor C3 (in the coil circuit of CMPF relay) prevents the CMPF relay from momentarily operating as RM stepping switch moves from home position prior to operation of the CMP relay.

5.30 PERCENT BREAK SEND CONTROL FUNCTIONS

5.31 Specific values of percent break can be established for pulsing transmitted during loop or magnet testing. Figure 5—3 is a simplified diagram showing the overall send conditions used for loop testing. Figure 5—4 is a simplified diagram showing the overall send conditions used for magnet testing. The percent break values associated with selected loop, leak, and magnet test conditions are listed in a table on the schematic diagram, Figure 7—1.

NOTE

Before selecting (programming) specific loop (LP) and leak (LK) test percent break values into the 26BXP Pulsing Panel, an initial percent break of 60.5% is established via the ADJUST % BREAK control on the basic TTS 26B test set.

5.32 The specific percent break values desired for testing with the 26BXP Pulsing Panel are programmed into the pulsing panel with its key switch S2 at CAL % BRK position. This position interrupts clamp lead ground to the 26B test set SEND relay, allowing the SEND relay to follow pulsing generated by the test set DRIVE relay. This CAL % BRK switch position also connects the test set's send output through the 26BXP pulsing panel and back to the receive portion of the test set. In this state, the percent break of the generated pulses can be read on the test set meter.

5.33 Figure 5—5 shows the major conditions established for the 60.5% break adjustment. Note that prior to this adjustment, the RLS pushbutton (or RST pushbutton) must be pressed to release any of the LK or LP relays which may have been previously operated. An operated LK or LP relay could erroneously switch a pulsing panel bias circuit in parallel with the test set's bias circuit. With reference to the table in Figure 7—1, note that a 60.5% break is associated with the transmission of pulses when a leak condition is inserted.

5.34 In magnet testing, ground and open pulses at 67% break must be supplied to the magnet under test. See Figure 5—6. Pressing the LK pushbutton on the TTS 26BXPC control unit energizes the pulsing panel LK2 relay. Operated LK2 completes the circuit for bias adjust LK resistor R16. This control can then be adjusted to obtain a 67.0% indication on the test set meter. Note that the CIRCUIT selector switch on the TTS 26BXC Circuit Panel is in NORM position for this adjustment.

5.35 When in LKA, LKB, or LKC positions the 26BXC unit's CIRCUIT switch applies ground to the coil of pulsing panel LK2 relay to prevent LK2 operation. Otherwise, a 67% break would occur during A, B, and C leak testing. The pulsing panel LK1 relay provides holding for the LK2 relay. The LK2 relay would otherwise release when the LK pushbutton on the control unit is released. (The LK3 relay does not perform any function during magnet test operation.)

5.36 Figure 5—7 shows the major functions used to provide a 68.5% break. Pressing the LP pushbutton on the TTS 26BXPC control unit operates the pulsing panel LP relay. The operated LP relay switches in bias adjust LP resistor R15. This control can then be adjusted to obtain a 68.5% indication on the test set meter.

5.37 Figure 5—8 shows the send conditions established when leak A, B, or C positions are selected on the CIR-

CUIT switch of the 26BXC Circuit Panel. In leak A, B, and C position, the CIRCUIT switch applies a ground which holds the pulsing panel LK2 relay deenergized. By preventing LK2 operation, the CIRCUIT switch ground insures that the desired 60.5% break will be generated instead of 67% break.

5.38 In leak C position, the 26BXC CIRCUIT switch supplies an additional ground signal which holds the pulsing panel LK3 relay deenergized. By preventing LK3 operation, the CIRCUIT switch ground allows the circuit panel's loop resistance to remain in a test loop when the control unit's LK pushbutton is pressed. Thus, both loop and leak conditions can be applied at the same time when the control unit's LK pushbutton is used with the 26BXC's CIRCUIT switch at leak C. Figure 5—9 shows this condition.

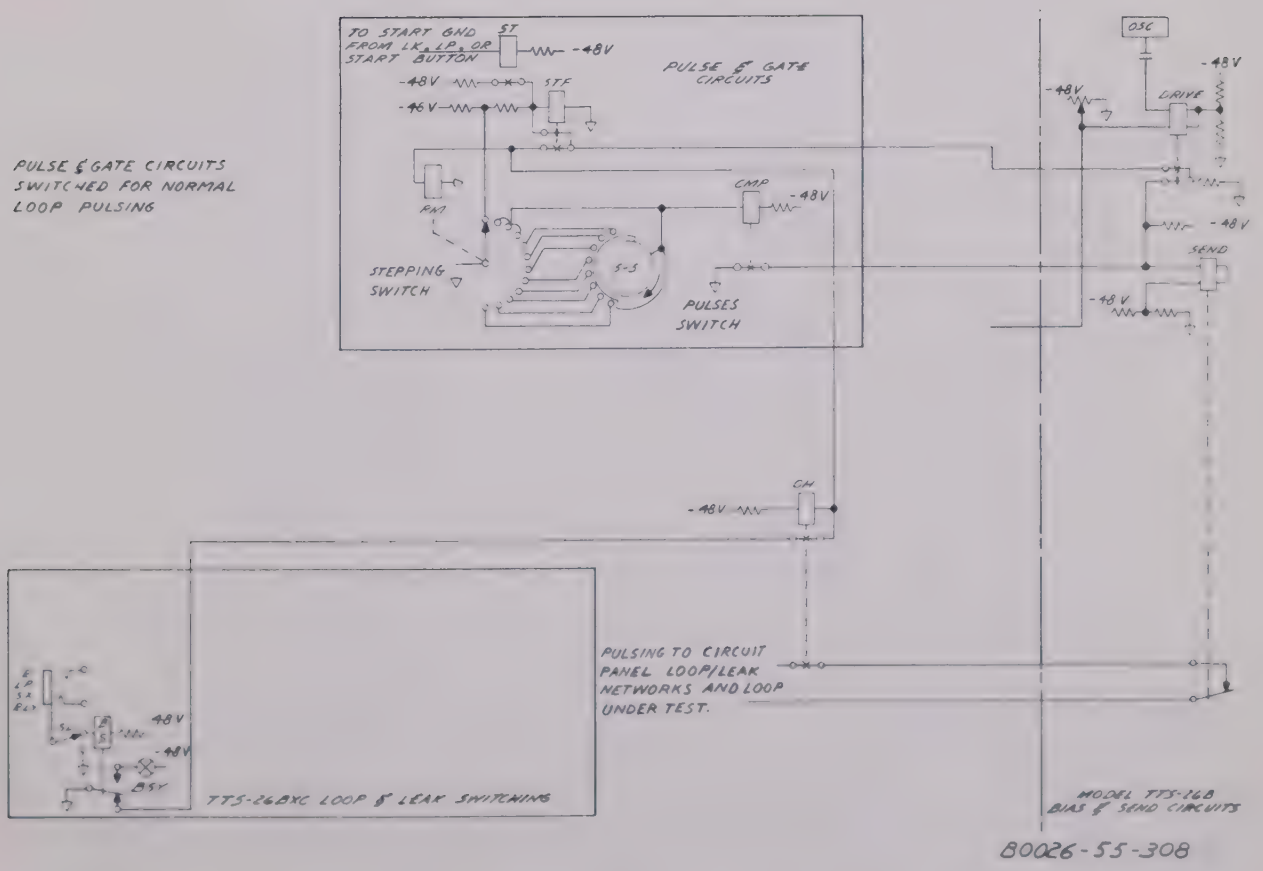


Figure 5—1. Gating Circuits Switched In For Normal Loop Testing.

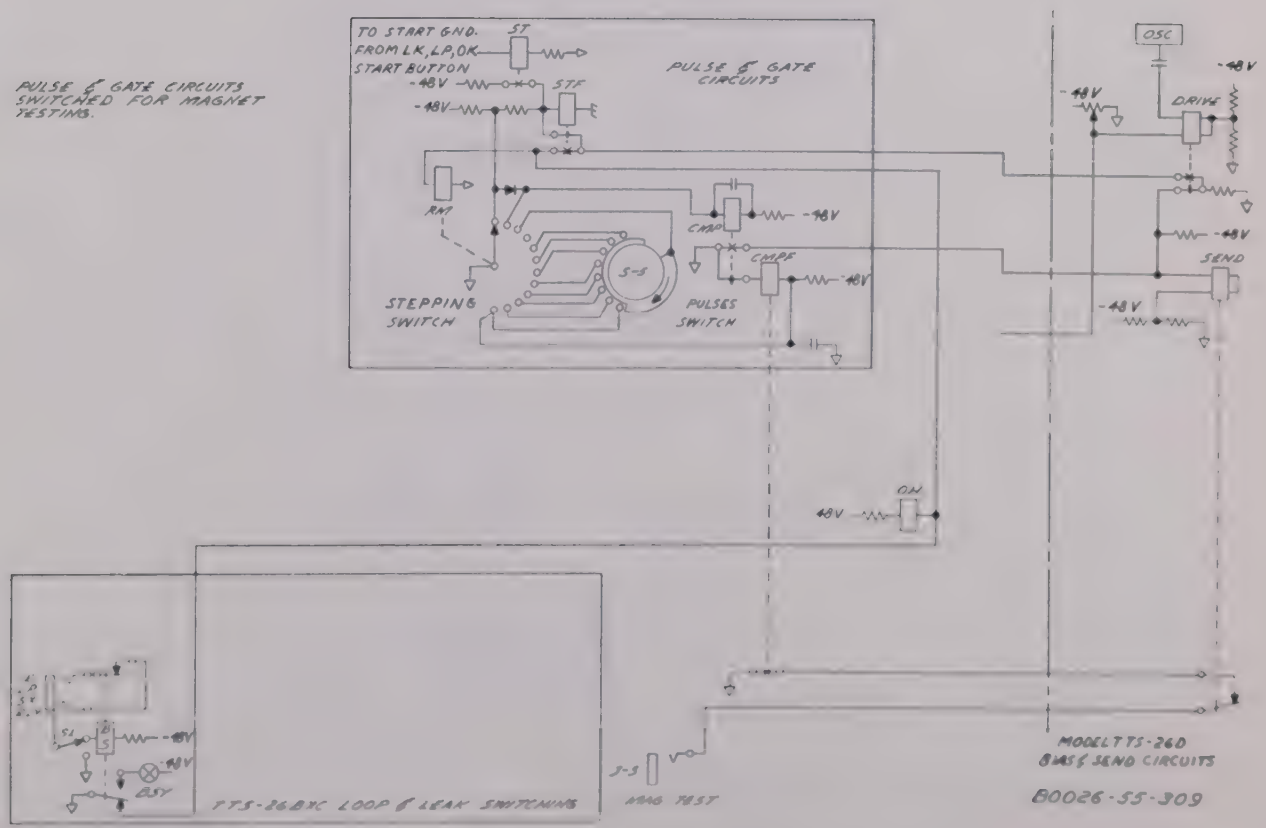


Figure 5–2. Gating Circuits Switched In For Magnet Testing.

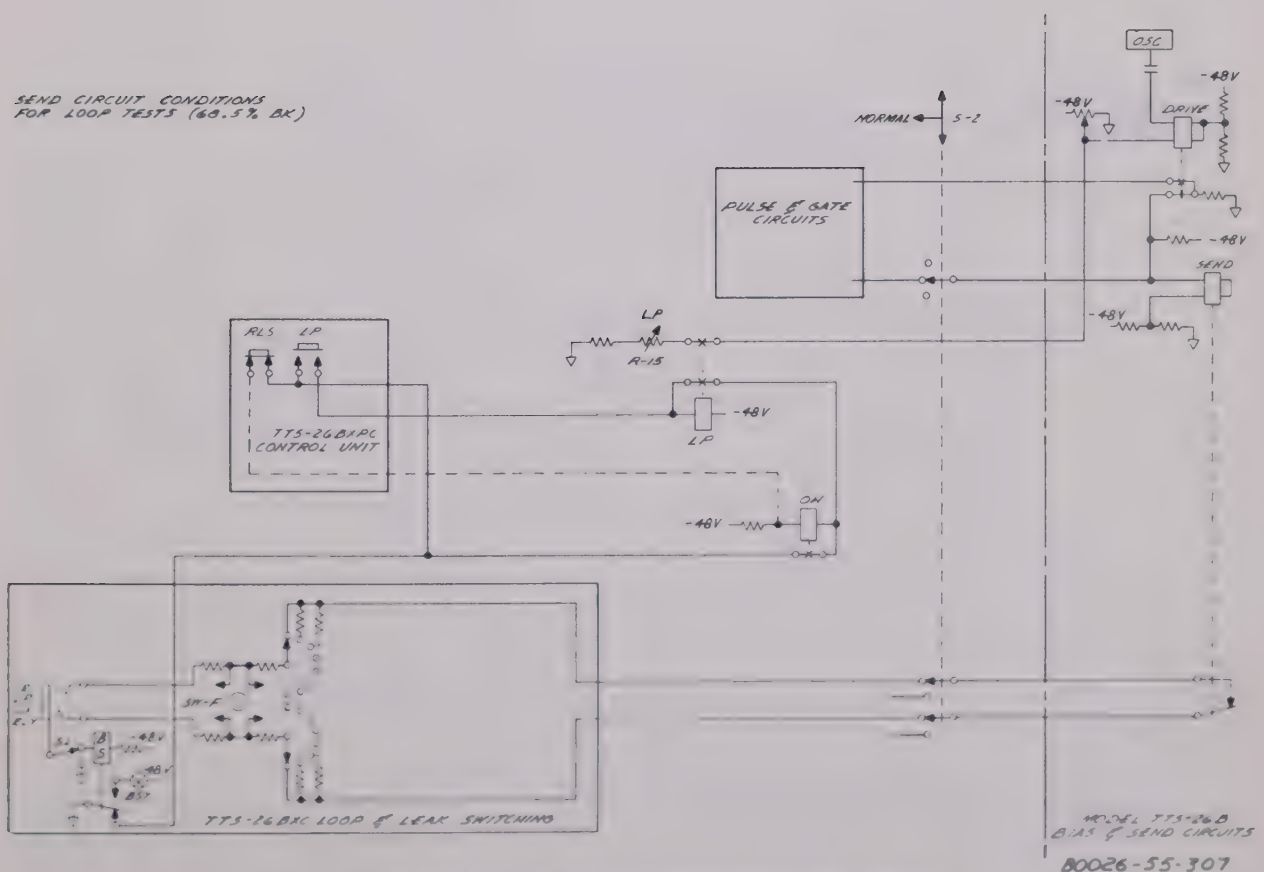


Figure 5—3. Send Conditions For Loop Testing.

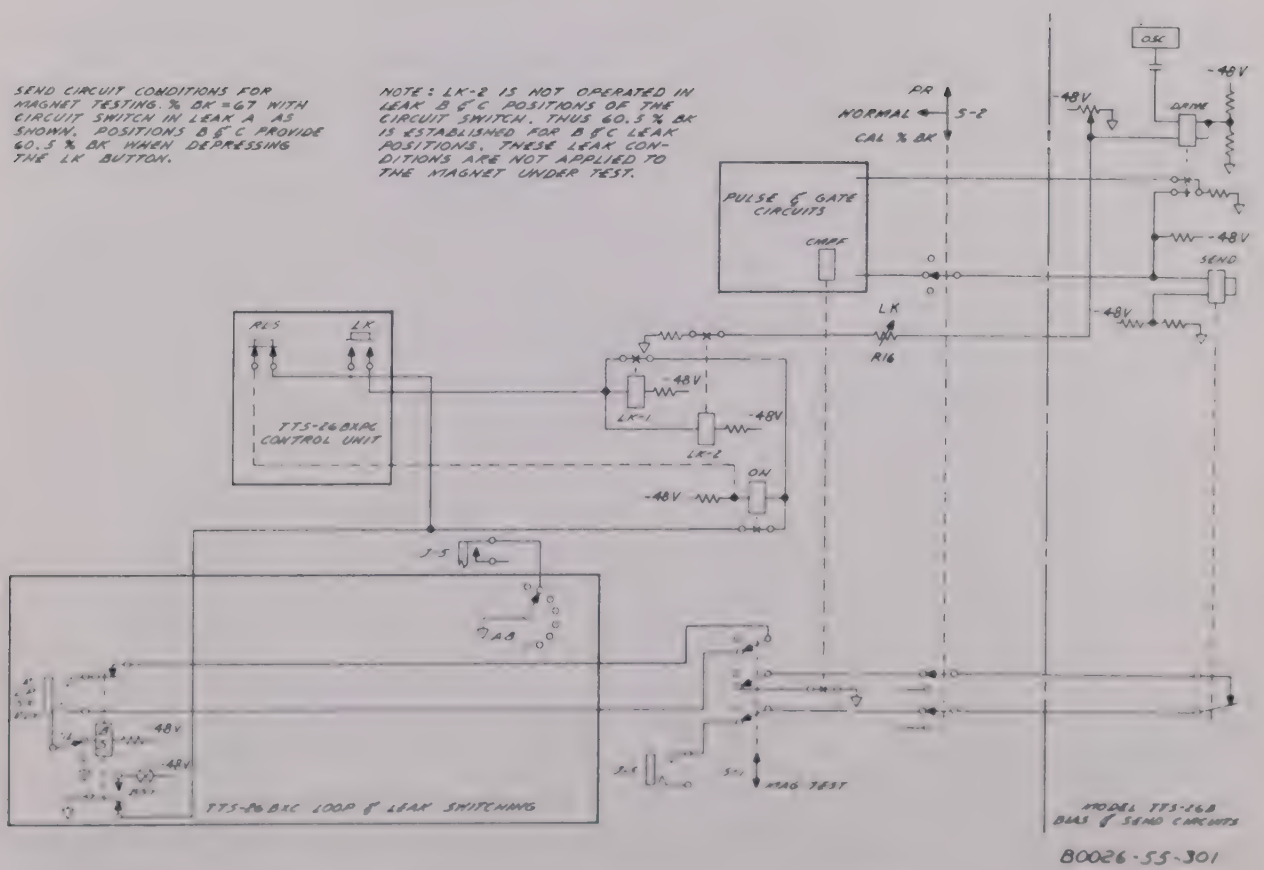

SEND CIRCUIT CONDITIONS FOR MAGNET TESTING. % BK = 67 WITH CIRCUIT SWITCH IN LEAK A AS SHOWN. POSITIONS B & C PROVIDE 60.5 % BK WHEN DEPRESSING THE LK BUTTON.
NOTE: LK-2 IS NOT OPERATED IN LEAK B & C POSITIONS OF THE CIRCUIT SWITCH. THUS 60.5 % BK IS ESTABLISHED FOR B & C LEAK POSITIONS. THESE LEAK CONDITIONS ARE NOT APPLIED TO THE MAGNET UNDER TEST.
OSC
-48V
PR
NORMAL
CAL % BK
S-2
DRIVE
PULSE & GATE CIRCUITS
CHRGE
SEND
RES
LK
TTS-26BXPC CONTROL UNIT
R16
LK-1
LK-2
ON
J-5
A8
MAG TEST
TTS-26 BXC LOOP & LEAK SWITCHING
MODEL TTS-26B BIAS & SEND CIRCUITS
80026-55-301

Figure 5—4. Send Conditions For Magnet Testing.

CAL % BREAK 60.5 %

DEPRESS RLS BUTTON PRIOR TO THE FOLLOWING ADJUSTMENT TO RELEASE THE LK OR LP RELAYS. ADJUST TTS-26B TO 60.5 % BK. (60.5 % BK IS USED IN CONJUNCTION WITH LEAK TEST FUNCTIONS)

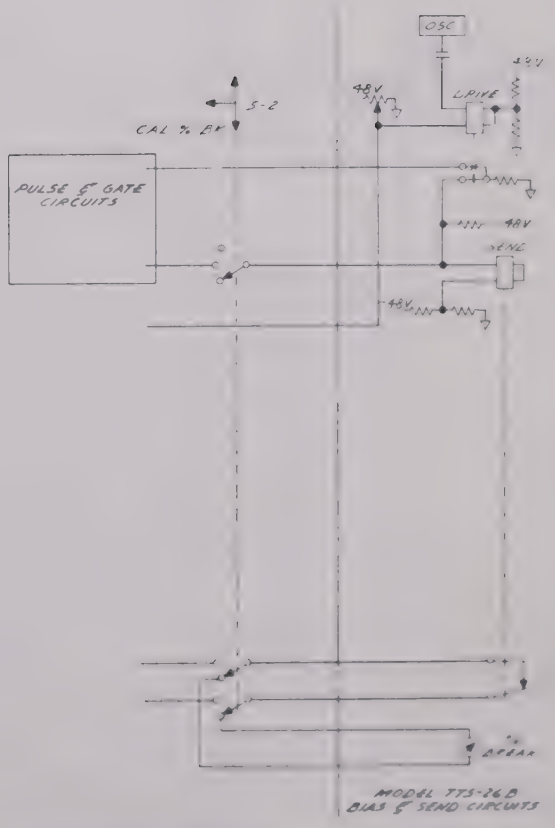


Figure 5—5. 60.5% Break Adjustment Conditions.

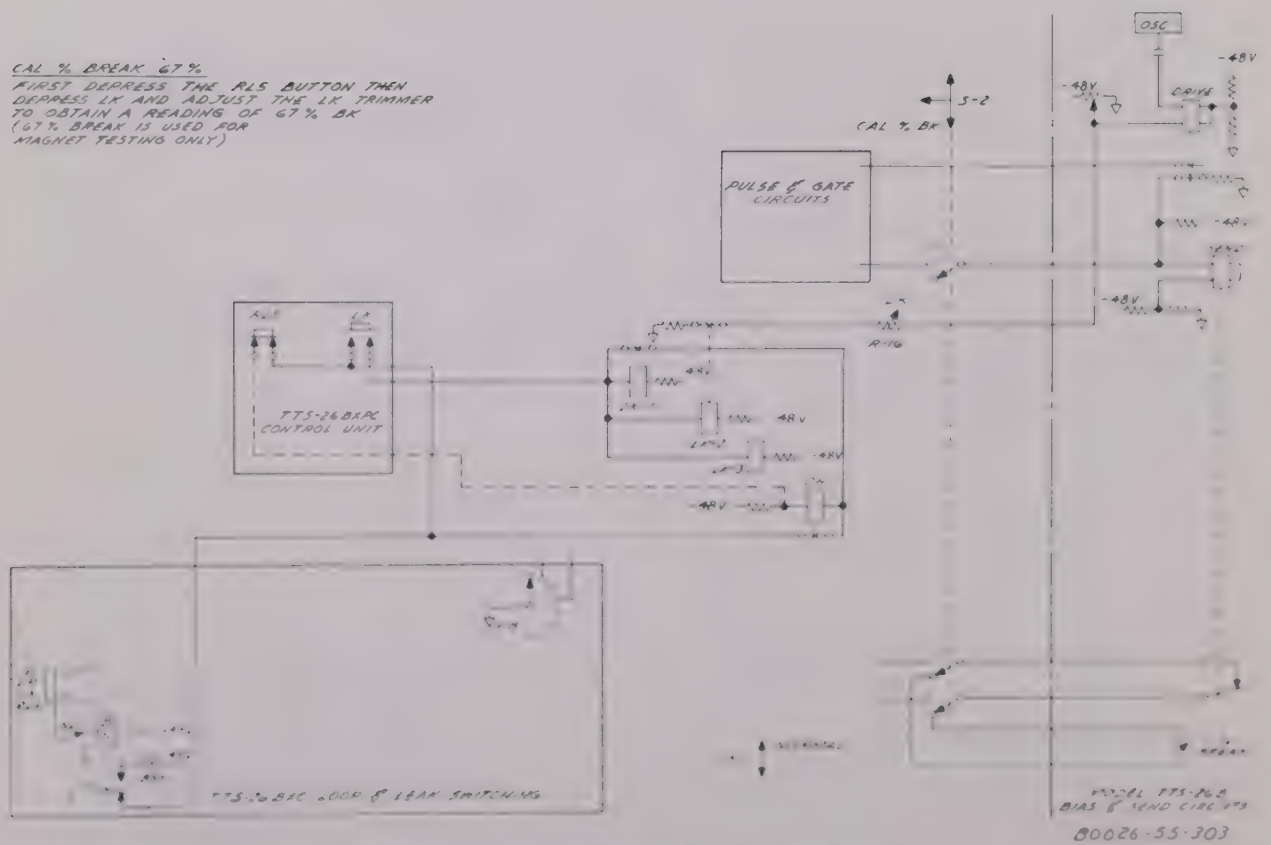


Figure 5—6. 67% Break Adjustment Conditions.

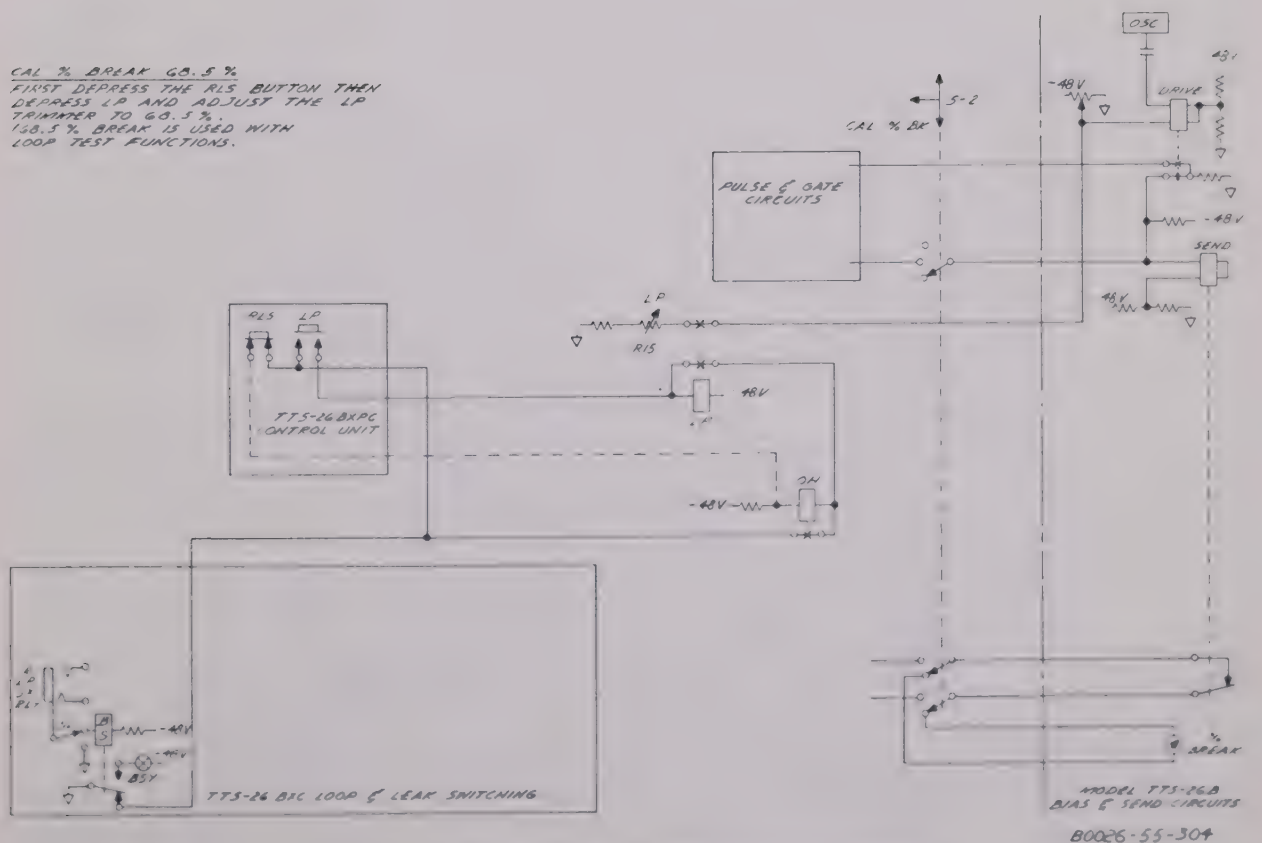


Figure 5—7. 68.5% Break Adjustment Conditions.

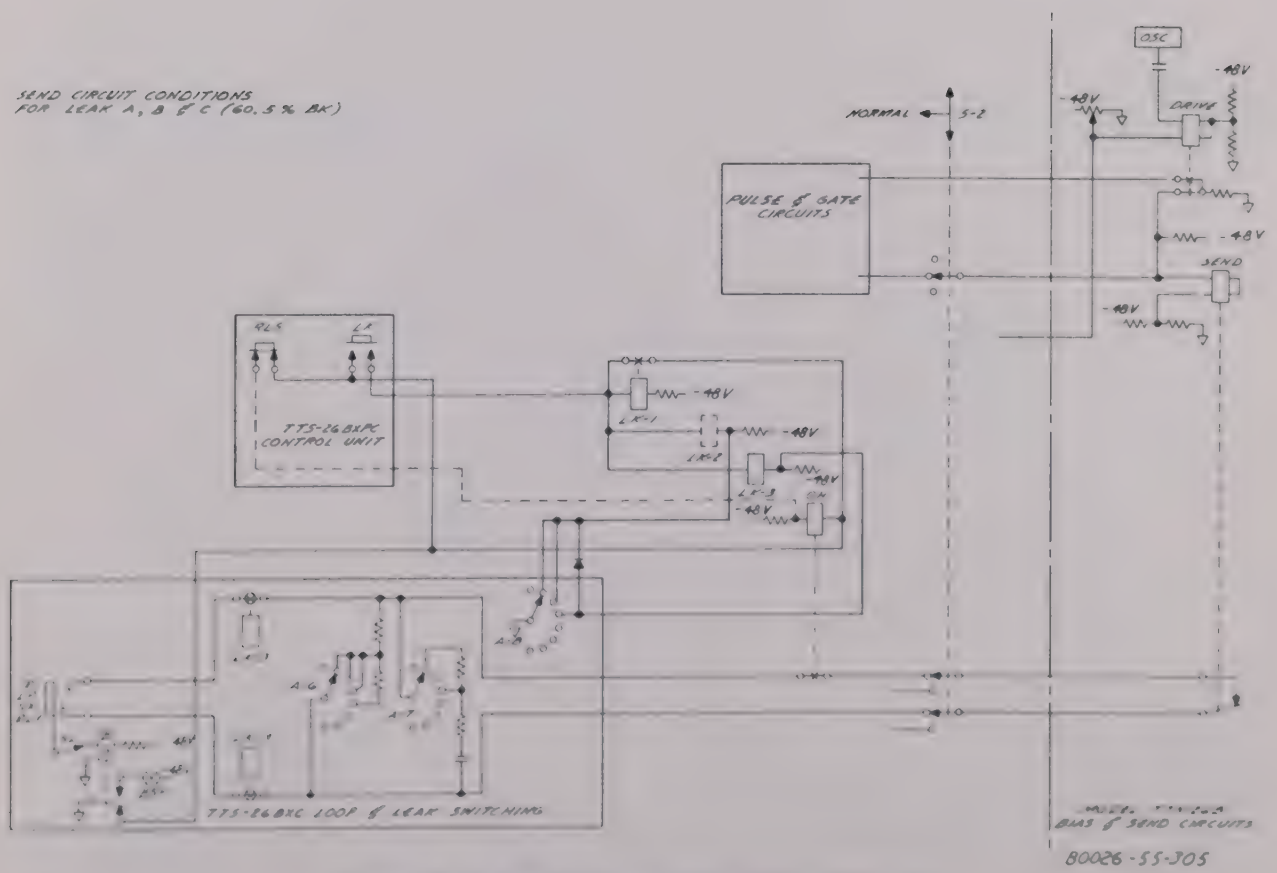


Figure 5—8. Leak A, B, and C Send Conditions.

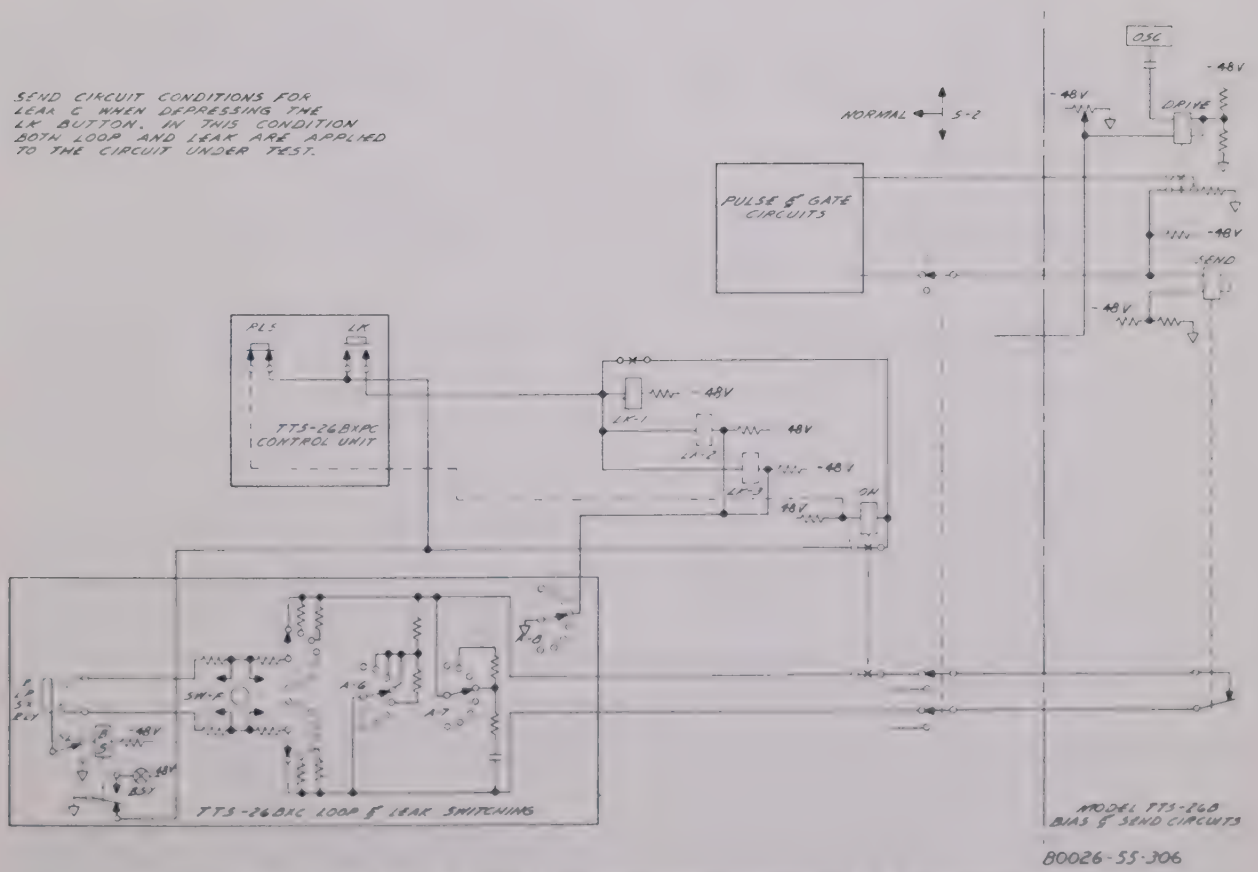


Figure 5—9. Leak C Send Condition When Pressing LK Pushbutton.

SECTION 6

MAINTENANCE AND ADJUSTMENT

6.1 MAINENTANCE

6.2 The TTS 26BXP Pulsing Panel requires no routine maintenance. Therefore, it is not recommended that the unit be removed from the case unless an actual malfunction occurs. If the unit is to be removed from the case for any reason, use extreme care. The connecting wiring must be carefully routed within the case to be sure that there will be no mechanical interference between the wiring and such parts as relays, stepping switches and so forth.

6.3 If a malfunction occurs, the basic test equipment needed for troubleshooting includes a brush or similar type of strip chart recorder. This is helpful in observing the sequential operations of various timing and relay circuits within the unit. A storage type oscilloscope can also be used for such observations.

6.4 TTS 26B/TTS 26BXP PERCENT BREAK ADJUSTMENT

6.5 The pulsing circuit of the TTS 26B test set must be matched to the circuits of the TTS 26BXP pulsing panel. The following procedure outlines how to adjust the test set to the pulsing panel. This adjustment should be done after:

1. installation of a TTS 26BXP Pulsing Panel,

2. repair or adjustment of the TTS 26B test set oscillator board, or

3. exchange of an accessory cover between two different TTS 26B test sets.

6.6 To adjust the percent break, perform the following steps.

1. Remove the TTS 26B test set from its case. Four captive screws hold the test set secured to the case.

2. With no power applied to TTS 26B test set, check that the meter reads 100.0 percent. Adjust the meter screw as necessary.

3. After an adjustment, back off the adjustment screw slightly to remove mechanical contact between the screw and the meter mechanism.

4. Insert the connector plug on the cord of the accessory cover into the EXTERNAL ADAPTER jack on the TTS 26B test set and lock it in.

5. Patch the SEND RELAY jack (on TTS 26B) to the SEND RLY jack (on TTS 26BXP) with a three-conductor cord having 310-type plugs.

6. Patch the REC LOOP jack (on TTS 26B) to the REC LOOP jack (on TTS 26BXP) using a tip-ring cord with 310-type plugs.

NOTE

If the accessory cover contains a TTS 26BXPS Power Supply omit steps 7 and 8. Plug the power cord into a 115 Vac power source.

7. Insert the 310-type plug of tip-sleeve patch cord into one of the test set 48 VOLTS jacks. Observe that correct polarity is maintained for the power source to be used.

8. Connect the other end of the patch cord to the 48 Vdc power source.

9. Set 26B SEND PPS switch at 12

10. Set 26B FUNCTION switch at CAL MTR and adjust METER CAL control to obtain 0.0 percent on the meter.

NOTE

The test set should be used in the position that it was calibrated, either vertically or horizontally.

11. Set switches on test set as follows:

a. FUNCTION key switch at SEND OSC,
b. SEND turn button at RT ON 1 & 2,
c. SPARK SUP at OFF,
d. METER CIRCUIT at % BREAK DIRECT,
e. RECEIVE switch fully clockwise,
f. SEND switch at SEND LOOP REC LOOP,
g. FUNCTION switch at SEND & REC.

12. Insert the TTS 26BXPC control unit plug into the A and B jacks on the TTS 26BXP pulsing panel. . . the knurled side of the plug toward the A jacks.

13. On the TTS 26BXP panel, set switches as follows:

a. PULSES switch at 9,
b. CAL % BREAK/NORMAL/PR key switch at CAL % BREAK,
c. LK ADJ % BREAK control fully clockwise,

d. LP ADJ % BREAK control fully clockwise.

14. On the TTS 26BXPC control unit, press RLS pushbutton.

15. On the TTS 26B test set, set the ADJUST % BREAK control to obtain 42.0% on the meter.

16. Press the LP pushbutton on the TTS 26BXPC control unit.

17. Observe that TTS 26B test set meter reads 83% to 85%. If necessary, adjust potentiometer R19 on the test set oscillator to obtain 83.0% on the meter.

18. Repeat steps 14 through 17 as necessary to obtain 42.0% and 83% to 85% without further adjustments.

19. On the TTS 26BXP pulsing panel, press the RST pushbutton.

20. Press and hold the 26BXP START pushbutton.

21. Listen to hear that the pulsing panel RM relay still operates at 38% as the ADJUST % BREAK control is slowly rotated clockwise.

22. Press the pulsing panel RST pushbutton.

23. On the TTS 26B test set, set SEND PPS switch at PWR OFF.

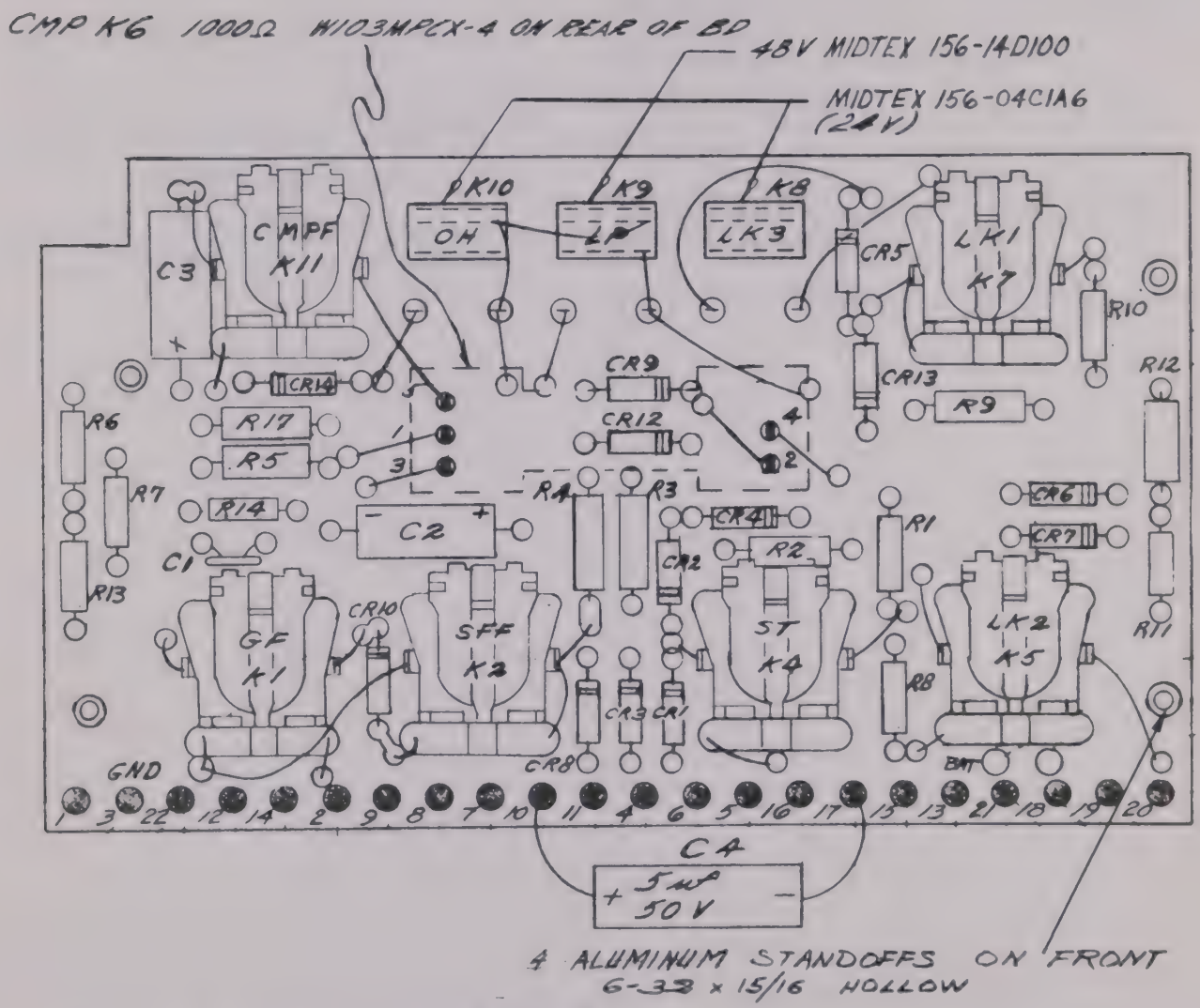
24. Disconnect from power source, and disconnect all cables between pulsing panel and test set.

25. Replace the test set in its cover and secure the screws.

SECTION 7

DIAGRAMS

7.1 This section contains schematic and assembly diagrams for the TTS 26BXP Pulsing Panel and TTS 26BXPC Remote Control Unit.



NOTE:

● SHADED AREAS (FRONT) 2027-B LUGS.

Figure 7—1. Model TTS 26BXP Printed Circuit Board Parts Location Diagram

OVERALL PULSING TESTS (LOCAL TYPE SWITCHES)

1- INSERT PATCH CORDS AND CALIBRATE TTS-26B FOR 60.5% BREAK THEN RETURN CAL KEY SWITCH TO ITS NORMAL POSITION.
2- INSERT CIRCUIT INTO JACK J-1 OF TTS-26BXC UNIT.
3- OBSERVE "BUSY" LAMP ON TTS-26BXC, CONTINUE WITH TEST IF NOT BUSY.
4- THE LOOP CIRCUIT CONDITIONS ESTABLISHED BY THE CIRCUIT SWITCH, WHEN OPERATED IN CONJUNCTION WITH THE TTS-26BXP, ARE AS LISTED ON THE CHART BELOW:

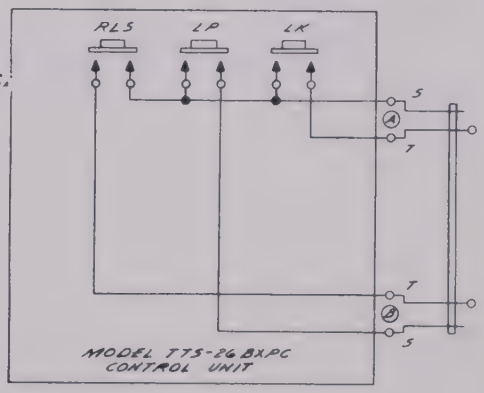
POSITION OF CIRCUIT SW. ON TTS-26BXC	PUSH BUTTON SW ON TTS-26BXPC LK	LP	SEND CIRCUIT CONDITION % BREAK	LOOP	LEAK
NORMAL	X		67.0%		X
"		X	68.5%	X	
LK-A	X		60.5%		X
"		X	68.5%	X	
LK-B	X		60.5%		X
"		X	68.5%	X	
LK-C	X		60.5%	X	X
LK-C		X	68.5%	X	

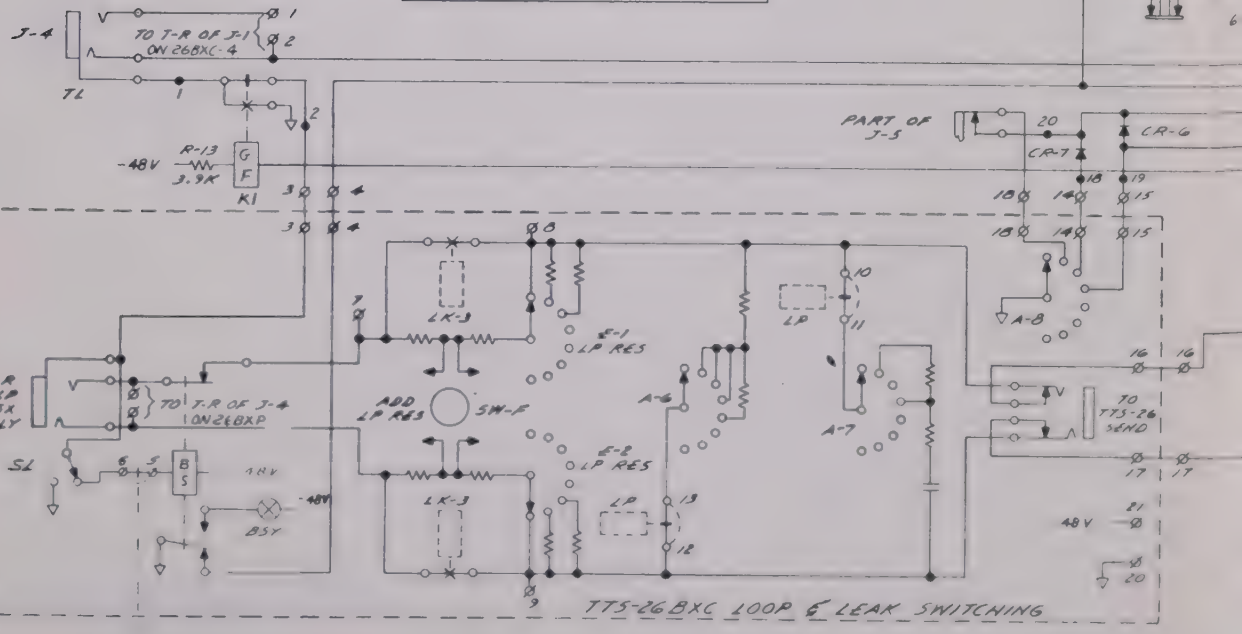
MAGNET PULSING TESTS

1- INSERT CIRCUIT INTO JACK J-3 TO ESTABLISH OFF HOOK, IF BUSY REPEAT WHEN FREE.
2- POSITION KEY SWITCH ON TTS-26BXP TO MAG TEST POSITION.
3- PATCH MAGNET UNDER TEST TO MAG TEST JACK ON TTS-26BXP.
4- LEAK-A PROVIDES 67% BREAK AND LEAK-B PROVIDES 60.5% OF THE GROUND & OPEN PULSES TO BE APPLIED TO THE MAGNET.

NOTES:

Ø = TERMINALS ON INTERCONNECTING TERMINAL BLOCK TB-8 (CINCH JONES TYPE 21-140 3/4 W)
ALL DIODES IN2069.
ALL RES. 1/2 W UNLESS STATED OTHERWISE.
● = TERMINALS ON PRINTED CIRCUIT BOARD.
○ = TERMINALS ON COMPONENTS: RELAY CONTACTS, JACKS, ETC.





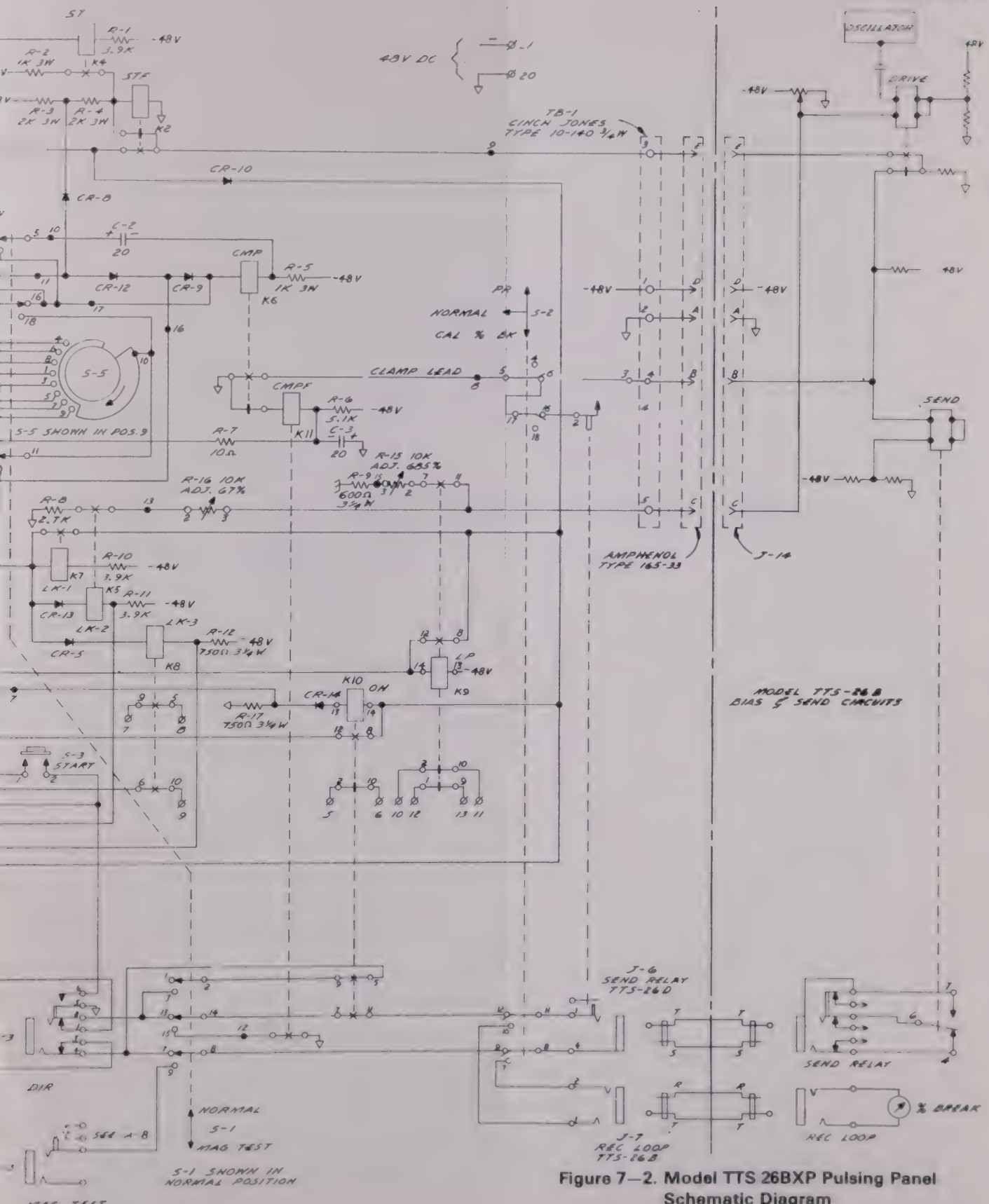


Figure 7—2. Model TTS 26BXP Pulsing Panel Schematic Diagram

SECTION 8

PARTS LISTS

8.1 This section contains parts lists for the TTS 26BXP Pulsing Panel and TTS 26BXPC Remote Control Unit.

Table 8—1. Model TTS 26BXP Pulsing Panel Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E. PART NO.
C1	.1UF		00	75V	CENTRALAB	DDA-104	330201040
C2-3	20UF			50V	SPRAGUE	TE1305	300202061
C4	5UF			50V	SPRAGUE	TE1303	300205051
CR1-10	D041	1A	SI	400V	EDAL	IN4004	560040040
CR11	D041	1A	SI	400V	EDAL	IN4004	560040040
CR12-14	D041	1A	SI	400V	EDAL	IN4004	560040040
J1-2	SPECIAL				SWCRFT	5J-1194	650401200
J3	SPECIAL				SWCRFT	5J-1191	650400900
J4	SPECIAL				SWCRFT	5J-1329	650401300
J5	SPECIAL				SWCRFT	5J-1191	650400900
J6	JACK,TEL,SWCRFT SCHEM 5				SWCRFT	MT-333	650400400
J7	SPECIAL				SWCRFT	5J-1329	650401300
K1-2	2.5K			13V	P+B	RS5D-SPECIAL	604400300
K3	1-POL 12-POS				P+B	GM-1124	615200100
K4-5	2.5K			13V	P+B	RS5D-SPECIAL	604400300
K6	1K			24V	MAGNECRAFT	W103MPCX-4	602000100
K7	2.5K			13V	P+B	RS5D-SPECIAL	604400300
K8	RELAY,4C PLUG-IN				MIDTEX	156-04C1A6-24V	604102000
K9	2.6K			48V	MIDTEX	156-14D100	604100100
K10	RELAY,4C PLUG-IN				MIDTEX	156-04C1A6-24V	604102000
K11	2.5K			13V	P+B	RS5D-SPECIAL	604400300
R1	3.9K	1/2W	5%		AB	TYPE EB	200203925
R2	1K	3W	5%		W LEONARD	TYPE 3X	210301025
R3-4	2K	3W	5%		W LEONARD	TYPE 3X	210302025
R5	1K	3W	5%		W LEONARD	TYPE 3X	210301025
R6	5.1K	1/2W	5%		AB	TYPE EB	200205125
R7	10-	1/2W	10%		AB	TYPE EB	200201006
R8	2.7K	1/2W	5%		AB	TYPE EB	200202725
R9	600-	3W	5%		W LEONARD	TYPE 3X	210306015
R10-11	3.9K	1/2W	5%		AB	TYPE EB	200203925
R12	750-	3W	5%		OHMITE	4418	210307515
R13	3.9K	1/2W	5%		AB	TYPE EB	200203925
R14	150-	1/2W	10%		AB	TYPE EB	200201516
R15-16	10K	5W	10%		CTS	AW-10000	231401030
R17	750-	3W	5%		OHMITE	4418	210307515
S1	1C-1C-2C-2C				S CARLSON	170K	630100200
S2	2C2C-1C1C CONTACT				S CARLSON	213398-000	630101000
S3-4	SPDT RED				SWCRFT	903	635400100
S5		2.75A		15V	CRL	PA-2042	625200200

Table 8—2. Model TTS 26BXPC Remote Control Unit Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLTS	MFGR.	MFGR. PART NO.	N.E. PART NO.
P1	PLUG,TWIN 2-WIRE,BLK				SWCRFT	411	651300400
S1-3	SPDT RED				SWCRFT	903	635400100